DOCUMENT RESUME

ED 310 174 TM 014 012

TITLE	Research Perspectives on Education. Occasional Paper No. 41.
INSTITUTION	Human Sciences Research Council, Pretoria (South Africa). Inst. for Educational Research.
REPORT NO	ISBN-0-7969-0627-0
PUB DATE	88
NOTE	307p.; Pages 155-156 are missing from the copy received by ERIC. Document contains small, light type which may not reproduce well.
PUB TYPE	Collected Works - General (020) -- Reports - Research/Technical (143) -- Books (010)
EDRS PRICE	MF01/PC13 Plus Postage.
DESCRIPTORS	Academically Gifted; Community Education; Computer Assisted Instruction; Curriculum Development; Database Management Systems; *Educational Research; Educational Trends; *Foreign Countries; Learning Processes; Mathematics Achievement; Parent Participation; Reading Instruction; *Research Projects; Research Reports
IDENTIFIERS	LOGO Programing Language; Research Trends; *South Africa

ABSTRACT

Perspectives on educational research are presented, and articles are included that reflect research projects that were undertaken at the Institute for Educational Research (IER) of the Human Services Research Council of the Republic of South Africa (RSA). Articles in this collection include: (1) "Educational Research in the RSA: Trends and Perspectives" (S. W. H. Engelbrecht); (2) "Trends in Educational Research in the RSA from the Sixties up to and Including 1986" (A. Schoeman and A. Muller); (3) "Fluctuation Analysis: A Proposed Educational Experimental Design" (A. W. Drost); (4) "The Logo Learning Environment in Research Perspective" (A. Muller); (5) "The Use of a Data Base Management System as an Exploratory Learning Opportunity with a Microcomputer" (J. G. Knoetze); (6) "Trends in Community Education and Their Relevance to the Provision of Community Education in South Africa" (G. D. Kamper); (7) "Guidelines for the Formulation of Objectives and the Selection of Learning Contents for Basic Education in the RSA" (L. Pienaar); (8) "Environmental Analysis as a Factor in Curriculation" (I. van der Stoep); (9) "Approaches to Learning to Read with a View to Designing an Initial and Remedial Reading Programme" (A. Dednam); (10) "Parental Involvement in the Education of Gifted Children" (J. B. Haasbroek); (11) "A Brief Report on South African Mathematics Olympiad Medallists from 1966 to 1983" (P. G. Le Roux); and (12) "An Empirical Investigation of Student Learning" (D. L. Hattingh). Summaries of the research activities of the IER and a list of 88 reports published in English and/or Afrikaans by the IER are included and an abstract in Afrikaans is also provided. (TJH)

ED310174

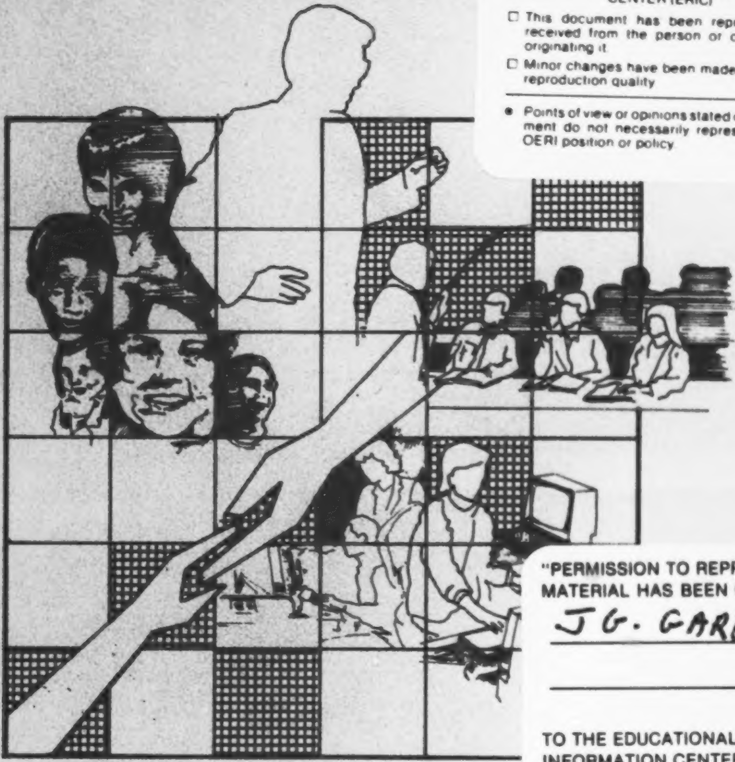
TM

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it

☐ Minor changes have been made to improve reproduction quality

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy



"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
J G. GARBERS

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Research perspectives on education

Institute for Educational Research

Occasional Paper No. 41

TM 014012

BEST COPY AVAILABLE

Occasional Paper — No. 41

Research perspectives on education

Institute for Educational Research

Pages 155-156 are missing from the copy received by the ERIC System.

Pretoria
Human Sciences Research Council
1988

Institute for Educational Research
Executive Director: Dr S.W.H. Engelbrecht

ISBN 0 7969 0627 0

© Human Sciences Research Council, 1988

Printed and published by the HSRC
134 Pretorius Street
Pretoria

PREFACE

Since the establishment of the HSRC on 1 April 1969, the Institute for Educational Research (IER) has been involved in research and development to contribute towards the improvement of education in the RSA. In the pursuit of this goal, the institute has initiated timeous and relevant research programmes, including also that research requested by institutions from the public and the private sectors. The number of research reports published by this institute since its inception exceeds three hundred, and a diversity of methodological approaches can be identified. The range of topics dealt with in these reports covers almost every significant theme in educational research; it varies from preprimary to primary, secondary and tertiary education and embraces the informal, formal and non-formal fields of education.

The infrastructure of this institute facilitated the HSRC Investigation into Education by making available expert and administrative support for the investigation. The HSRC Education Research Programme, a continuation of the Investigation into Education, is also accommodated within the IER for administrative and organisational purposes. Personnel of this institute have thus become involved in a large number of comprehensive research programmes as co-ordinators, researchers or in a supporting capacity. Experts and researchers from outside the HSRC have also been actively involved on a partnership basis in this research programme. This has led to the emergence of yet another function of the IER, namely co-ordinating research in education.

Research undertaken in the IER has always reflected an awareness of the education needs of this country. The findings of the research were therefore often implemented in practice. Many examples of this which even led to changes in legislation can be cited. During the seventies research reports on differentiated education and on school guidance were published. Research on the teaching of the natural sciences, Mathematics and Latin as well as research involving, *inter alia*, programmes for remedial reading and for school readiness also took place and educational practice could benefit to a large extent.

This publication attempts to provide an overview of the IER and recent research undertaken in the institute. Some of the articles are based on current or completed research in the institute and in some cases, published in recent reports. Other articles were specially written for this publication on the initiative of authors. The articles reflect the wide range of research activities in the IER. The contributions vary from perspectives on research methodology and trends in educational research in the country to contributions on macro-aspects in education such as the need for curriculation in non-formal and formal education to more specific themes such as approaches to initial reading and the status of research on the use of Logo. With a few exceptions, each one of these articles was read and evaluated by at least one person not attached to the IER and considered an expert in the particular field dealt with in the article. The following persons are thanked for their contributions as external evaluators:

Prof. M.J. Bondesio
Prof. L.P. Calitz
Prof. J.J. de Wet
Prof. C.S. Engelbrecht
Prof. J.C. Engelbrecht
Dr E.W. Fullard
Prof. G.S. Harley
Prof. W.A. Landman
Prof. J.L. de K. Monteith
Prof. M. Skuy
Prof. I.N. Steyn
Prof. P.A. van Niekerk
Prof. S.H. von Solms

The following persons were members of the editorial committee for this publication:

Mr A. Muller
Mrs C. van Zyl
Dr F.J. Nieuwenhuis
Mrs M.A. de Waal
Mr G.D. Kamper (who has since left the HSRC)

Other co-workers were Mmes E. Hilliard, S.E. Naudé, R.I.M.L. Battheu, A. Herman and M.B. Esterhuyse. The front cover was designed by Mrs L. Hearne and Mr E. Fullard. Each one of these persons made a valuable contribution towards the completion of this publication and a word of thanks is extended to them.

The IER trusts that this publication will not only shed light on the extent and variety of its research activities, but that it will also make a contribution to the rich field of literature on education that already exists in South Africa.

S.W.H. ENGELBRECHT
EXECUTIVE DIRECTOR

EKSERP

Hierdie geleentheidspublikasie bied perspektiewe op onderwysnavorsing en sluit artikels in wat onder andere handel oor navorsingsprojekte wat binne die Instituut vir Opvoedkundige Navorsing (ION) van die RGN onderneem is. Daar is ook artikels ingesluit wat nie direk aan 'n ION-projek gekoppel kan word nie, maar wat oor temas handel wat in die huidige onderwysnavorsing aktueel is. Vir die leser is daar 'n oorsig oor die samestelling van die ION, die missie van elk van sy navorsingsafdelings en die kundighede of hulpbronne wat in dié instituut beskikbaar is. Tendense in die onderwysnavorsing in die RSA, beide inhoudelik en uit metodologiese hoek, geniet onder andere aandag, so ook temas soos basiese onderwys, kurrikuleringsaangeleenthede (omgewingsanalise, norme en standaarde), die rekenaar in die onderrig (Logo, databasisbestuur) en gemeenskapsonderwys.

ABSTRACT

This occasional publication presents perspectives on educational research and includes articles that reflect research projects that were undertaken in the Institute for Educational Research (IER) of the HSRC. Articles are also included that are not directly related to a research project of the institute, but that deal with themes that are current in educational research. The reader is provided with an overview of the composition of the IER, the mission of every research division and the expertise or resources available in the IER. Trends in educational research in the RSA, both regarding content and methodology, receive attention as well as themes such as basic education, curriculum issues (environment analysis, norms and standards), the computer in teaching (Logo, data base management) and community education.

EDUCATIONAL RESEARCH IN THE RSA: TRENDS AND PERSPECTIVE

S.W.H. ENGELBRECHT

1. INTRODUCTION

At present the RSA is experiencing a hitherto unknown interest in the provision of education. The HSRC Education Report pointed out the deep-seated problems confronting educational provision in this country and formulated a number of suggestions for dealing with some of these problems. The White Paper on the Provision of Education in the RSA reflects the government's views on the report and its recommendations, and certain fundamental aspects involving management structure, co-ordinating mechanisms and the principles for the provision of education have already provided a basis for legislation in this regard.

Three developments resulting from the report are worthy of mention. In the first place the vital role of the provision of education - taking into consideration its limitations - was highlighted in respect of its importance to a balanced society and balanced social development. The overwhelming response during the investigation as well as after its completion is a clear indication of the fundamental importance attached to education by all population and interest groups in South African society. Education is vital to society and its functions and structures on all levels of government should be weighed carefully and judged in accordance with the needs, expectations and attitudes of all the groups concerned. Secondly, the report drew attention to the multidimensional nature of education, particularly to dimensions such as non-formal education, which in the past was often treated as relatively unimportant, and about which very little was in fact known. Thirdly the report emphasized the role of continued educational research and its importance to the meaningful development, maintenance and expansion of an acceptable system for the provision of education.

However educational research as such is by no means a straightforward concept. It has many facets and poses numerous unique problems, but in respect of all these - as will become evident time and again - the fundamental problem involves the place of educational research in the social structure and its possible contribution to orderly and systematic progress. Accordingly the following related matters are addressed:

- The epistemological or paradigm problem
- Basic versus applied research
- Macro versus microresearch
- Meta-analyses in educational research
- Dissemination of research results
- Co-ordinating, stimulating and financing research

The aim is to put each of the problems involved in perspective with the aid of local and overseas literature and to spell out the findings in terms of local research and research priorities.

2. THE EPISTEMOLOGICAL OR PARADIGM PROBLEM

Elsewhere in the world and in the USA in particular, educational research is experiencing a period of self-examination such as this discipline has never before been exposed to. Superficially - yet nevertheless of critical importance to all those involved - the question examined concerns the usefulness and possible application of educational research. The severe criticism expressed in this regard is illustrated by the following quotations:

"... serious educational research studies supported by millions of dollars have yielded only vague and contradictory results" (Gage, N.L., see Farley 1982: 11).

"... educational research ... has failed to yield significant or useful findings concerning the main effects of educational variables" (Gage, N.L., see Farley 1982: 11).

"It has no doubt been vexing to many in the field and embarrassing to many in the university staff that educational research hasn't come up with anything that especially improves learning or enhances teaching ..." (Blatt 1980).

These are only a few examples. It is significant that many writers trace the problem back to the root of educational research, namely its epistemological basis. On the one hand there is confusion and uncertainty with this basis and on the other hand disillusionment. The frankness with which the blame for the failure of educational research is cast upon the basic assumptions on which it is founded, is quite astonishing.

Research conducted by Kuhn (1970) on the development of paradigms in the natural sciences has certainly resulted in a better understanding of this aspect of educational research and has placed it in the proper perspective. Some broad epistemological trends that are compared critically are idealism against realism, and positivism against humanism.

Positivism and behaviourism are placed under the first heading (idealism). Both claim to have their origin in the natural sciences and attempt to find general explanations, comprehensive patterns and universal principles. The latter (realism) contains a compendium of paradigms including phenomenology, hermeneutics, reconceptualism and various other trends which all advocate a more practical, situation-bound approach to educational problems.

The intention here is not to examine this problem in depth or to offer a lengthy philosophical argument. The reaction to and criticism of Kuhn's findings, the multiplicity of paradigms and their points of contact, the possibility of an ecumenical paradigm, the synthesizing of paradigms, or perhaps their very irreconcilability, and the relation between paradigms and ideological points of view and methodological preferences are mentioned merely to underline the complexity of the problem. However the following factors do play an important role in this argument:

- The endeavour to obtain a better insight into a meaningful scientific framework or profile has specific implications for scientific research. The choice between a practical and a theoretical model has a direct bearing on the choice of the educational problems to be researched, which in turn directly influences the possible implementation of research findings. A major factor in determining the method of research to be used, is whether the problem is defined as detached from the situation or whether it is situation bound.

- The choice of paradigm has specific consequences in respect of the involvement of the user in the research on the one hand, and on the other hand for the feasibility of interdisciplinary or multidisciplinary research. In an article on educational paradigms, Tuthill and Ashton (1983) describe the practicability of Kuhn's paradigm model for education and express the following view:

"In order for science to progress in education, it is essential that educational scientists and practitioners work together, as members of the same paradigmatic communities, solving the same paradigmatic puzzles" (p.9). The most important adjustment made in respect of Kuhn's model, is therefore that a research community operating within a particular paradigm and constituting one of the basic concepts of the paradigm philosophy should be expanded in the science of education to include research users.

With a view to enlarging upon the above argument and also to link up with the reference to interdisciplinary and multidisciplinary research, it would seem that research that will be valuable in practice can only be conducted or rather should preferably be conducted with the appropriate involvement of all the research partners: the user, who could be either teacher/lecturer/training officer or policy maker, participants from other appropriate disciplines, and finally the general user public. The opportunity to publicly debate the research (findings) so as to obtain the views of a wider public than only those responsible for the implementation of the research results, is seldom found in research, despite the fact that it represents a particularly powerful *mechanism*. It is argued that the absence of such public debate may be the reason why educational research often fails to innovate.

A final remark on the epistemological debate relates to the phenomenon that research generated from a particular paradigm has certain practical consequences, which in turn affects the financing of research. The danger therefore exists that if ill-considered applications of particular paradigms continue, money will not be allocated for further research. Although in the eyes of the research financer *this may seem like a justifiable practice*, educational research as such has nothing to gain from it.

As far as educational research in the RSA is concerned, it appears that although attention is from time to time given to the epistemological problem, the interest in it is less intense than elsewhere. An analysis of local research during the past 15 years shows that research dealing specifically with this problem occurred mainly within the framework of fundamental pedagogics. Some of these studies touch on themes such as a metatheoretical examination of a few pedagogic schools of thought, the possibility of an interdisciplinary discourse, tension between determinism and indeterminism among a number of contemporary, West German educational philosophers, the achievement of unity of thought in pedagogics and the *science idea* in education.

A perusal of a selection of articles published in prominent South African pedagogics magazines during the past few years reveal a promising trend. Apart from numerous articles touching on the periphery of the problem, there are others that explicitly attempt to contribute to the problem area, e.g. the article by Brezinka (1981) on a metatheory for education, a critical discussion of an epistemological basis for pedagogics as a science, by Schoeman (1982) and Nelva Coss' article on the application of Thomas Kuhn's paradigm concept in education. The "Pedagogiekjoernaal" also carried a surprising number of articles on related themes, several of which were contributed by overseas experts.

Generally speaking though, one would still be inclined to maintain that different theoretical frameworks for education as a science do exist in the RSA and that normal scientific praxis takes place within the context of these paradigms.

Except for the sporadic criticism of the competitive paradigm, there is at present no question of a shift of paradigms or even of an in-depth debate on the merit of the various paradigms. In this connection one can refer to Coss's quotation from Ritzer's work in which it is pointed out that although different paradigms can exist within a particular discipline, they are constantly competing with one another for hegemony. All attempts to establish unified consensus thought in the field of pedagogics should be viewed in this light. However if Schoeman's view is correct that the basis for the differences does not lie in reason, but in a far more deep-seated dimension of human existence, there is little hope of a reconciliation. On this basis it seems more likely that a shift of paradigms will occur in the discovery of anomalies by those practising a particular paradigm, than as a result of criticism emanating from another paradigm. A few of the practical problems that are created by such a pluralistic paradigm framework and that impede educational research in the RSA are:

- The possibility of co-ordinated and co-operative basic educational research, and to a lesser extent of applied and of micro- and macrodirected research is reduced. Although in its Education Research Programme the HSRC has succeeded in gaining the co-operation of researchers supporting different points of view, this was probably only because the nature of the problems examined in no way involved the pedagogical premises of the researchers. It is likely that this problem will come to the fore more strongly in projects that are more microdirected.

- While research is being conducted from within different paradigms, the possibility for meta-analyses is limited. In the RSA the shortage of manpower in this field aggravates the problem. Owing to the limited number of studies being conducted in respect of particular problem areas, there is little chance of findings being integrated in a meaningful scientific way.

- Research is in danger of becoming nothing more than a form of journalism practised without a theoretical framework, or a mixture of basically irreconcilable theoretical frameworks/paradigms which can seriously affect the quality of research.

3. BASIC VERSUS APPLIED RESEARCH

The debate on this matter is as old as (educational) research itself. Although it is included in the above problem, it is more fundamental and much wider. However it would be wrong to link basic research with theoretically oriented educational paradigms, and to link applied research with the so-called practical paradigms. In both these instances it is more a case of a shift of emphasis in respect of the purpose of research, the research hypotheses that have to be formulated and the vision of the researcher regarding the direct applicability of research. Krahtwohl (see Farley 1982: 14) maintains that, unlike basic research, applied research spells out the expected social implications. He feels that the funds available for educational research in the USA are inadequate. In this respect he refers to a suggestion by the National Council for Education that 25 % of all funds available for educational research should be voted for basic research. The present trend, namely to give priority to projects in accordance with their supposed practical value, has resulted in very little financing for basic research. In my opinion the dilemma faced by American educational research is that the strong behaviouristic paradigm with its positivistic nature results in research directed at the uncovering of universal truths, which have little practical value. Despite the fact that this research can be formulated as applied research, its practical advantages are few, causing the body responsible for the financing of education to be even more sceptical about basic research.

However the fact remains that the quality of applied research is determined by knowledge of the particular field of study - in this case the scope and depth of educational theories. In other words, at any given time the quality of applied research is co-determined by the quality of the existing theoretical framework within which it operates.

Therefore, while normal applied research is conducted within a specific paradigm, it is equally important that researchers should continue with their positive examination of the dominant paradigm with a view to its elaboration or the discovery of anomalies within the paradigm. The absence of this exercise will lead to stagnation, while the continued support of an obsolete paradigm can have serious implications. The history of science provides numerous examples of this kind. It is therefore necessary, for the sake of the orderly advance of science and the obtaining of the optimum advantage from applied research results, to maintain a realistic balance between basic and applied research. Precisely what such a balance should be is debatable.

According to a survey conducted for the Directorate of Scientific Planning by the HSRC's Institute for Research Development, this proportion was 43,3 % basic and 39,9 % applied for the human sciences during 1982. Naturally this proportion is not necessarily applicable to educational research. An analysis of the approximately 4 200 current and completed educational research projects embarked on and registered with IRD in the RSA since 1969 (and up to 1986) also fails to give a clear picture as the title of an investigation alone makes accurate classification impossible. Research aimed at clarifying this matter should receive attention.

4. MACRODIRECTED VERSUS MICRODIRECTED RESEARCH

A distinction needs to be made between macrodirected and microdirected educational research in view of the distinction made between the provision of education on the macro, meso and microlevels. Although literature on education also distinguishes between macrotheory and microtheory (e.g. Glaser in Farley 1982), microdirected research in this case refers to research applicable to the microeducational situation. According to Glaser (see Farley 1982: 16) what is involved is research aimed at learning and teaching activities and the conditions for effective learning. At issue is cognition, problem solving, the sizes of classes and schools and factors within the school context that promote effective teaching and learning. Research currently receiving priority in the USA, as identified by leading experts (a number of former presidents of the American Educational Research Association), indicates an emphasis on microdirected educational research. This can possibly be ascribed to the fact that research conducted during the preceding decades concentrated primarily on macroproblems such as equal quality and equal opportunity. Experts such as Gage, Bloom, Krahtwohl, Gagné, Glaser, Ebel, Thorndike, Kerlinger, Popham, Farley and Greene (Farley 1982) predict that future research will be concerned mainly with matters such as the following:

* conditions for learning
* classroom process variables

* classroom management structure
* use of time in the classroom
* classroom flexibility and pupil background
* cognition, and problem solving

* development
* memory structure
* social processes
* artificial intelligence
* effective knowledge, talents and skills

The term macrodirected educational research refers to research directed at those co-ordinating functions and structures by means of which effective teaching in the classroom situation can be promoted. This research is therefore concerned with factors outside the classroom situation and is related to the management structure of a system for providing education, financing education, teacher training, supporting structures (curriculation, guidance, medical services) and broad matters such as educational structure. It also includes matters indirectly related to education, for instance research aimed at improving educational provision. The macroresearch referred to by the above experts includes educational research methodology, educational standards, educational financing, curriculation and legal, legislative and bureaucratic matters.

The importance of the differentiation between macrodirected and microdirected research lies in the operationalization framework created by the former for the practical teaching and learning situation. Teaching and learning can only be optimally realized in a management structure in which factors such as macroco-ordination, financing, support services, curriculum and standards have been fully taken into account.

A balance between macrodirected and microdirected research is therefore essential in order to establish a system of educational provision that will meet all the needs of a country, as well as those of individual learners. This naturally makes one wonder to what extent this balance has been achieved in the RSA. A general survey gives the impression that the majority of microstudies are conducted in the fields of Psychopedagogics and Subject Didactics, while most studies in Comparative Education, Historical Pedagogics, General Didactics, Methodology (teacher training) and Organization, Administration and Planning are microdirected.

5. META-ANALYSES IN EDUCATIONAL RESEARCH

Recent overseas literature shows an increasing incidence of meta-analyses or metastudies in educational research. The concept meta can have various meanings, but many authors avoid definitions, leaving it to the reader to decide what the word conveys in a particular context. In his analysis of the concept Thomas (1984) also mentions its multiple meanings in combinations such as metaphysics, metaprinciple, meta-analysis, metacognition, metamemory, etc. and expresses the view that the two most popular uses of the term "meta" in connection with education are:

(a) "Knowledge of" or "an analysis of" the basic concept to which the meta is linked, i.e. metacognition and metamemory.

(b) "Co-ordinating" or "all-embracing", or the inclusion of numerous aspects of the phenomenon under discussion, e.g. in metaprinciples and meta-analysis (p.18).

To these one can probably add two further common uses, namely "meta" in the sense of "transcendent" or "highly abstract" as in metaphysics, and "meta" indicating "change" (one of the original Greek meanings) as in "metagogics". The meaning that we wish to assign to "meta" is the one attached to it by Glass (see Thomas 1984) in the combination "meta-analyses". Glass distinguishes between the primary, secondary and meta-analyses of research data. Primary analysis refers to the initial analysis of data for a research project, secondary analysis represents the next step, involving the analysis of the same data but using more advanced statistical techniques, and meta-analysis refers to the analysis of analyses. The latter analyses the collected research studies concerned with a particular theme in order to integrate the various findings. As Glass puts it: "It connotes a vigorous alternative to the casual, narrative discussions of research studies which typify our attempts to make sense of the rapidly expanding research literature."

Meta-analyses of this kind were responsible for bringing to light some serious shortcomings in contemporary American educational research. One such rigoristic meta-analysis was conducted in respect of research aimed at comparing different teaching media. This not only subjected research conducted over a period of several decades to the complete spectrum of empiristic-positivistic criteria, but also produced results which, for two reasons, were surprising and illuminating. In the first place the number of meaningful research projects, in terms of the desired criteria, were reduced to less than 1 % of the total, and in the second place metaresearchers concluded that at most the research results supported the null hypothesis.

Regardless of the results of such a meta-analysis, the fact remains that a need exists for the outlining of research results for all parties involved in the implementation of research findings. In a sense this can be said to be the aim of each candidate for a thesis when he examines the research on which his theme is based. It also constitutes an integral part of any scientific research project, regardless of the level at which it is undertaken. However the problem is that such analyses frequently suffer from what can be typified as informal informative discussions of the type of research already conducted in that specific area, while a truly penetrating analysis of the research subject in terms of the criteria of the paradigm within which it was conducted is lacking. The frequency with which researchers relate their own research themes, designs and even their research findings to research results published elsewhere, without carefully scrutinizing the validity of the design used by the researcher(s) involved, is quite alarming.

Such meta-analyses serve a dual purpose: while informing the research community of the development of research in a particular field, particularly in respect of the cumulative and progressive nature of the research involved, and indicating existing gaps with a view to further research, they represent an excellent technique for subjecting the prevalent paradigm, or the paradigm concerned, to a strict scientific evaluation since in this way any anomalies developing inside the paradigm must essentially be revealed.

On the other hand analyses of this kind may lead to conclusions which have considerable practical value for the partners in educational research, for example teachers and policy makers. The problem is however that meta-analyses as such are always conducted within the context of the researcher/scientist's framework of reference and has not yet been "translated" for the user. A further discussion of this point will follow at a later stage.

Suffice it to say that in South Africa meta-analyses as research on research - i.e. metaresearch - is almost non-existent and that the research community can benefit from such studies.

6. CO-ORDINATING, STIMULATING AND FINANCING RESEARCH

Recently the increased and active co-ordination of research has gained considerable importance. The main reasons for this are

- the rise since the fifties of policy-oriented research and research aimed at decision making. Not only the governments of various countries (including the USA, West Germany, Sweden, England and the RSA), but also a number of private institutions, acted on the assumption that educational research could make a fundamental contribution towards formulating policy and decision making. This resulted in the stimulating and financing of research and, accompanying this, the demand for a co-ordination of efforts to avoid unnecessary duplication, and

- closely related to this, the view that research, planning, policy formulation and implementation are complex processes and that any system of planning will only function optimally when the alliances between the aspects mentioned are well developed (Ketudat and Fry, 1981). Here the implication is once again that co-ordinated research activities are the most likely to make a cost-effective contribution. As far as the stimulating and financing of educational research is concerned, the preceding development resulted in a tremendous increase in the financing of research projects, particularly by the governments of different countries. In those countries previously referred to, mechanisms and structures were invariably created to facilitate the financing of research. Torsten Husén (1984) feels that the sixties were the golden era of educational research, which enjoyed systematic and large-scale support in the hope that it would achieve greater productivity and efficiency in education. However, as stated before, educational research failed to meet the expectations, resulting in a cut-back of funds made available for this type of research in those countries mentioned above and particularly in the USA. At the same time greater demands are being made in respect of the applicability of research results and the responsibility of researchers and research organizations.

Meanwhile the debate on the optimal financial contribution of the state to educational research continues in several countries, with an indication that this may eventually be determined as a percentage of the total amount spent on education in a particular country. In this respect various authors mention 1 % of the total education budget as the ideal, but this has not even been achieved in any of the prominent western countries. According to Marklund (1981) approximately 0,29 % of the total education budget in Sweden is spent on research and development. Nesbit (1980) points out that although between 1963 and 1974 there had been a tremendous increase in the amount spent on educational research in Britain, the present spending (1980) still amounts to only 0,1 % of the total spending on education. In South Africa a total of R9 729 286 was spent on research and development in respect of educational and counselling services during 1981/82, while the total budget for education during that period amounted to R2 946 million. Of the total amount spent on education, 0,3 % was therefore used specifically for research and development.

In the RSA the greater co-ordination of educational research efforts is of the utmost importance. Matters have improved to such an extent over the past decade or two that it has now become evident that research definitely has a place in the entire system of educational provision. The HSRC Education Report not only spelled out the importance of educational research for the policy maker and planner, but the principle emphasizing the role of education research has been formally accepted by the government. This clearly indicates that in the decade ahead, educational research will be called upon to assist with the solving of cardinal problems in education. However, since expert manpower in this field is limited, it is essential to ensure that no unnecessary duplication of research areas will take place.

Since, as elsewhere in the world, educational research is not yet receiving optimal financial support, there will have to be a continued effort to convince the authorities that a larger percentage of the education budget should be made available for research. As will later become evident, there are a number of priority research areas which will have to be considered urgently to ensure the optimal functioning of the proposed system for the provision of education.

7. RESEARCH PRIORITIES

Within the context of determining research priorities it is important to distinguish between two particular categories of research. In the first place we have conclusion-oriented research, mentioned above, which consists mainly of self-initiated or free research and often involves basic and/or microdirected research. Secondly we have policy-oriented research or research directed at decision making, which is initiated and financed in the belief that such research will contribute towards the solving of educational problems. Since this type of research often puts the policy maker in a position in which he can legitimize decisions and defend these in public debate, different mechanisms are in this case required to determine priorities.

Whereas in the former case a voluntary participation in the determining of priority seems ideal, it is particularly in the latter that actions for the determining of universally valid priorities have recently been initiated in a centralized way. Smit (1984) refers to the metamorphosis evident in research councils since they started determining research priorities and directing research by organising national programmes. The role of the SAPRHS and the HSRC Educational Research Programme in the determining of research priorities with macro educational implications for the RSA is well known. According to Smit the greater emphasis on interdisciplinary research, the joint investigation of socio-economic problems, the formulation of long-term research strategies and the determining of research priorities have already contributed a great deal towards improving the quality of research results.

Taking into consideration completed and current research, and in the light of the HSRC Education Report and the White Paper on the Provision of Education in the RSA, the priority areas for the future should be the following:

- Curriculation: In view of the suggested educational structure which emphasizes bridge modules, basic, prebasic and postbasic educational phases and the optimal flow of pupils through the system, curriculation in respect of all these phases and facets are critically important.

- Educational standards: The problems related to educational standards are closely linked with the problems encountered in respect of curriculation and examination. It would appear that in the past this very real problem has been seriously neglected. The expected increase in the number of pupils involved in black education and the ideal of equal educational opportunities can only widen the scope of this problem. Quality research will have to be carried out to support the Central Statutory Certification Council in this difficult task.

- Mobility of learners: Although this matter is already being dealt with in research projects, the complicated nature of the relations between formal and non-formal education and the creation of mechanisms to bring about horizontal flow will demand concentrated and co-ordinated research.

- Educational needs of the black child: It is clear that the amount of research conducted in this area is totally insufficient. A few of the aspects of this problem to which attention may be given are: the educational situation of the black child, the self-image (self-concept/vocational concept) of the black child, the problems surrounding the black child and the influence of home and school environments on school achievement, own experience and creative expression.

- Non-formal education: Here the emphasis can be placed on any of a number of issues, but it is above all the problem of illiterate black adults and the resultant widening gap between black parents and their children that demands intensive and dedicated research.

- Metaresearch: As stated before, an urgent need exists for the meta-analysis of existing research in order to inform the research community of research development in different areas of priority to enable them to co-ordinate and direct research in a systematic way.

8. DISSEMINATION OF RESEARCH RESULTS

Throughout the world there is an increased awareness of the close interdependence of research, planning and the formulating and implementing of policies. Furthermore it has been realized that the dissemination of research data plays an important role within this activity. While in other parts of the world mechanisms and structures for the dissemination of research data are being created or planned, very little attention has so far been given to this aspect of research in the RSA. In the first phase of the HSRC Investigation into Education, innovation strategies and coping with resistance to innovation did receive some attention, but this action has meanwhile been stopped. During the first phase a great deal of effort was also made to "translate" research results for policy makers and users.

This concept is of vital importance. Researchers should always remember that the user of research findings - on micro-, meso- and also macro-level - belongs to the research community and needs to be informed. This supply of research findings may however not be regarded as a one-way activity in which the user is dependent on the researcher's publications in technical journals or on information obtained from formal reports. If research is to have an effect on what is happening in the field of education, it is essential that the research results of projects - preferably those of a series of related projects - should be made available to the user in a form in which it will be useful to him.

9. SUMMARY

In this article an attempt has been made to explain certain fundamental perspectives concerning educational research in the RSA. As stated at the beginning, the motif is always the impact that educational research actually has, and can have, in practice. It should be clear that harmony between basic and applied, and microdirected and macrodirected research is essential, while the co-ordination of educational research and the effective and meaningful dissemination of research findings is a requisite for significant educational research. In respect of each of these matters the HSRC, IER and the HSRC's Education Research Programme in particular can make an important contribution. It may be said that the major task for this decade would be the involvement of all the partners in educational research in a wider vision which will be meaningful to all. The success already achieved in this respect within the HSRC Education Research Programme has convinced us that the HSRC will be able to play a leading role in the future development of educational research.

REFERENCES

ARMSTRONG, D.G. Researcher's incentives and the dearth of practical research results : Peabody Journal of Education 58(1), October 1980 : 55-60.

BAIN, H.P., GROSECLOSE, J.R. The dissemination dilemma and a plan for uniting disseminators and practitioners. Phi Delta Kappan 61(2), October 1979 : 101-103.

BAKER, E.L. Can educational research inform educational practice? Yes! Phi Delta Kappan 65(7), March 1984 : 453-455.

BASSEY, M. Pedagogic research: on the relative merits of search for generalisation and study of single events. Oxford Review of Education 7(1), 1981 : 73-94.

BLATT, B. Why educational research fails. Journal of learning disabilities 13(9), December 1980 : 3-4.

BREZINKA, W. Meta-theory of education : European contributions from an empirical-analystical point of view. South African Journal of Education 1 (1), 1981 : 120-127.

COETZEE, J.H. Metagogiek : 'n nuwe deeldissiplinêre benadering. Suid-Afrikaanse Tydskrif vir Opvoedkunde 3 (4), 1983 : 185-190.

COSS, Nelva. Thomas Kuhn's concept of a paradigm applied to education. Journal of Education, University of Natal 13, 1964 : 13-20.

EISNER, E.W. Can educational research inform educational practice? Phi Delta Kappan 65(7), March 1984 : 447-452.

FARLEY, F.H.(ed.) The future of educational research. Educational Researcher 11(8), October 1982 : 11-19.

FOUCHé, F. Pedagogics : the mystification of education and phenomenology. Journal of Education University of Natal 10, 1978 : 3-11.

GALLEGOS, A.M. In search of the significant. *Educational Researcher* 10(10), December 1981 : 4, 38.

GIDEONSE, H.D. The impact of educational research : reflections on the American experience. *International Review of Education* XXVII, 1981 : 121-133.

HEMPHILL, J.K. What we may have learned about educational research and development. *Educational Technology* 20(4), April 1980 : 51-53.

HOGAN, P. A critique of educational research. *Oxford Review of Education* 6(2), 1980 : 141-155.

HOLMES, M. The impact of educational research. *Education Canada* 12(4), 1972 : 23-29

HUSéN, T. Research and policymaking in education : an international perspective. *Educational Researcher* 13(2), February 1984 : 5-11.

JENSEN, A.R. *Political Ideologies and Educational Research* 65(7), March 1984 : 460-462.

KETUDAT, S., FRY, G. Relations between educational research, policy, planning and implementation : the Thai experience. *International Review of Education* XXVII, 1981 : 141-152

KUHN, T.S. *The structure of scientific revolutions*. Chicago : The University of Chicago Press, 1970.

LAPOINTE, A.E., KOFFLER, S.L. Your standards or mine? The case for the national assessment of educational progress. *Educational Researcher* 11(10), December 1982 : 4-9.

MARKLUND, I. Educational Research in Sweden : reform strategies and research policy. *International Review of Education* XXVII, 1981 : 105-119.

MAYHER, J.S. Understanding and using research. *English Journal* 72(2), February 1983 : 101-104.

MILLER, M., NAAS, J.F. Perspectives on research : sailing to windward. *Contemporary Research* 54(1), Fall 1982 : 37-41.

MITTCHELL, D.E., ENCARNATION, D.G. Alternative state policy and mechanism for influencing school performance. *Educational Researcher* 13(5), May 1984 : 4-11.

MULDER, J.C. Die gebruik van nomotetiese navorsing in die Opvoedkunde. *Educare* 12, 1983 : 1-17.

NISBET, T.J. The impact of research on policy and practice in education. *International Review of Education* XXVII, 1981 : 101-104.

OKON, W. The influence of educational research on education in Poland. *International Review of Education* XXVII 1981 : 163-177.

SCHOEMAN, P.G. Critical reflections on the epistemological basis of Pedagogics as a science. *S.A. Journal of Education* 2(1/2) 1982 : 24-29.

SCHUBERT, W.H. Recalibrating educational Research : towards a focus on practice. *Educational Researcher* 9(1), January 1980 : 17-23.

SCHULTZ, R.E. The conduct of educational R and D in an era of limits. *Educational Researcher* 10(10), December 1981 : 13-18.

SCRIVEN, M. Self-referent research. *Educational Researcher* 9(6), June 1980 : 11-18.

SMIT, P. Universiteitsnavorsing : enkele internasionale perspektiewe. *Navorsingsbulletin* 14(7), 1984 : 1-6.

TAYLOR, W. Educational Research and development in the United Kingdom: Framework, impact and future prospects. *International Review of Education* XXVII, 1981 : 179-195.

THERON, A.M.C. Onderwysverspilling : 'n metapedagogiese terreinverkenning van 'n aktuele probleem. *Educare* 11, 1982 : 43-50.

THOMAS, R.M. Mapping meta-theory. *Educational Researcher* 13(1), January 1984 : 16-18.

TUTHILL, D., ASHTON, P. Improving educational research through the development of educational paradigms. *Educational Research* 12(10), December 1983 : 6-14.

WALBERG, H.J., SHILLER, D., HAERTEL, G.D. The quiet revolution in educational research. *Phi Delta Kappan* 61(3), November 1979 : 179-183.

WELLER, L.D Contemporary research techniques: their potential for planning educational features. *Contemporary Education* 55(1) : Fall 1983 : 51-54.

WILSON, J. The credibility of educational studies. *Oxford Review of Education* 8(1), 1982 : 3-19.

TRENDS IN EDUCATIONAL RESEARCH IN THE RSA FROM THE SIXTIES UP TO AND INCLUDING 1986

A. SCHOEMAN
A. MULLER

1. INTRODUCTION

During the 1987 investigation into macro-aspects of the university in the RSA by the Committee of University Principals (CUP), it was concluded that research is an important facet of the activities of a developing and dynamic society. Research does not only play a role in economic development or in stimulating creativity and innovation; it also affects the intellectual life of a society and influences the thinking and standards that will be used as yardsticks for evaluating activities and intellectual production (Weisskopf in CUP 1987 : 54). In this regard the report comments as follows: "It is only by sustained independent and creative investigation that the necessary knowledge and insight can be acquired for physical survival in a technological world and for the spiritual and social adaptations and moral decisions which, apart from physical survival, are essential for ensuring a meaningful human existence. The threats of economic, scientific, technological and cultural boycotts and sanctions are further incentives for South Africa to initiate its own essential research activities". (CUP 1987 : 54)

2. FOCUS ON EDUCATIONAL RESEARCH

An institutional perspective on research in the RSA shows that the scientific councils, universities, technikons, colleges of education, agricultural colleges and the commercial sector not only undertake research, but are also largely responsible for the research output. A profile of the research output of these bodies would be informative, particularly that of educational research. Data have been made available on the research output of those institutions and organisations concerned with education, as well as on those disciplines in which research is mostly undertaken, particularly since education and its provision are an important priority in developing countries, and since the RSA faces enormous challenges regarding the expansion of educational opportunities for all its population groups.

3. THE NAVO DATA BASE

In order to determine trends in educational research, a printout was requested of the *completed* research collected in the **NAVO** data base of the HSRC's Institute for Research Development. (The term **NAVO** represents the research information data base and constitutes the first four letters of the Afrikaans term **Navorsinginligtingsdatabasis.**) The printout covers a period ranging from the sixties to the end of September 1986. The data base lists the author's name, the title of the research and its purpose (whether for degree purposes or non-degree purposes), the organization, the division within the organization, and the discipline. With regard to research for degree purposes, treatises, theses and dissertations for Masters' degrees and doctorates appear in the data base. Studies for non-degree purposes include research undertaken by such bodies as the HSRC, the education bureaux of the various education departments and colleges of education.

To process the data, the information in the **NAVO** data base was transferred to another data base management programme, dBase III, and the statistics were generated using this programme. Many interesting trends in educational research came to light, although the authors are of the opinion that this information should not be interpreted as *absolute* indicators of trends. Discussions with the staff responsible for the maintenance of the **NAVO** data base indicate that a regular updating of educational research output of a particular body or group of bodies does take place regularly but this does not exclude the possibility that some research could be incompletely recorded. A considerable amount of university research is also published in technical journals or conference papers. If the HSRC has not been informed about a project, the project will not form a part of the NAVO data base. It should further be borne in mind that the number of staff in an organization is a factor of the number of students, and that the research output cannot be seen in isolation from the size of the lecturers corps and the number of researchers. In this context attention is drawn to the fact that 73 % of students currently enrolled are at universities, 14 % at technikons and 12 % at colleges of education (CUP 1987. Question 4: 19). The data and interpretation of the data should always be seen against this background. Abbreviations and symbols used in the tables are explained in Appendix 1.

4. TRENDS IN EDUCATIONAL RESEARCH

Table 1 indicates the research for both degree and non-degree purposes, from 1969 to 1986. *No indication* (00) represents research without an indication of the date of completion. The 1986 information is incomplete since the HSRC receives most of its information in the year following the research. Out of a total of 2 932 research papers or reports, 1 534 or 52,3 % were presented for the M.Ed.-degree. A further 607 or 20,7 % were dissertations for the D.Ed.-degree. For non-degree purposes, 603 or 20,6 % of the research output appeared as research reports. Postgraduate studies in Physical Education (currently the Science of Human Kinetics) are also significant with 89 (3,0 %) research papers or reports. (Refer to the discussion of Table 3.) It is clear that, over the years, the total output per annum has been rising. From 1981 to 1983 the research output for non-degree purposes was considerably higher; this can possibly be ascribed to the HSRC Investigation into Education. In general it appears that qualifications obtained in education cover the whole spectrum of M. and D. degrees. Since the overall number of postgraduate students increases by 7,7 % per annum, an increasing trend in research for degree purposes can be expected. Postgraduate Bachelor's degrees, however, show the greatest increase while M and D degrees show a slower rate of growth - (CUP 1987 : 28).

TABLE 1: DIVISION OF RESEARCH FOR DEGREE PURPOSES AND NON-DEGREE PURPOSES ACCORDING TO YEAR (1969 TO 1986)

YEAR	PURPOSE OF RESEARCH																	
	NDP	D.Ed.	D.Ed.Ph.	D.Ed.(Phych.)	D.Phil.	D.Sc.	Ph.D.	Ph.D.(Phys.Ed.)	M. in Phys.Ed.	M.A.(Phys.Ed.)	M.Ed.(Phys.Ed.)	M.Ed.	M.Ed.(Phych.)	M.Phil.	M.P.Ed.	M.A.	M.Sc.	TOTAL
NO INDICATION 00	9											4						13
1969		8	1		2							36						47
1970	7	18			1		1			2		39				2		70
1971	6	14			2	1	3					41				1		68
1972	20	23					1					44			1			89
1973	13	27			1		4					61				2		108
1974	11	23					2				1	60				2		99
1975	38	28			1				1	1		54						123
1976	41	27					1		1	2		61				1		134
1977	29	28			1		3		1	1		74				1		138
1978	51	38					2	3	2	7		103				1		207
1979	61	41			1		2	1	3	8		92				2	1	212
1980	44	50					3		2	8		110						217
1981	76	49			1				3	3		121				1		254
1982	71	56			1		4	1	5	2		112					1	253
1983	54	57			4		1		4	7		123				1		251
1984	53	34		2			3	2	5	3		158		1		1		262
1985	17	58		1	3	1	9		2	5		142		5		3		246
1986	2	28					6		1			99	2			3		141
TOTAL	603	607	1	3	18	2	45	7	30	49	1	1534	2	6	1	21	2	2932

32

Table 2 indicates the output for both degree and non-degree purposes, per organization. As regards research for non-degree purposes, the output of the HSRC (including research within the SAPRHS) is the largest comprising 240 or 39,8 % of the total of 603. Other institutions with a significant output for non-degree purposes are UP with 84 or 13,9 %, and UOFS with 68 or 11,3 %. In terms of total research (for both degree and non-degree purposes) the greatest output was at UNISA (N = 603), followed by UP (N = 481), UOFS (N = 293), RAU (N = 264), US (N = 260) and PU for CHE (N = 237). Judging by the information in the data base, relatively little educational research is undertaken at universities such as WITS, RHU, UCT, UD-W, UFH, UN, UNIN, UPE, UWC and UZ. Out of a total of 607 D.Ed.-degrees, 24 or 4 % were obtained at English medium and black universities. One D.Phil. and 40 Ph.D. degrees were also obtained at these institutions. While 81 Masters' degrees were obtained in Physical Education at universities, only eight doctorates were obtained. (Refer to the discussion of Table 3.) It appears that only 42,6 % of students awarded M.Ed. degrees eventually attempt and complete their doctorates. At certain universities it appears that the ratio of degree purposes to non-degree purposes strongly favours research with a view to a degree, and that there is a relatively low output of research for non-degree purposes.

Table 3 reflects, per organization, the broad fields of study indicated in the NAVO data base as being of concern, for both degree and non-degree purposes. The total research output comprised 2 932 studies. These studies had been broadly categorized in the NAVO data base according to a number of study fields. Each of the following fields of study produced a frequency of more than 200:

*	Psychopedagogics	554 or 18,9 %
*	Philosophy of Education	394 or 13,4 %
*	Didactics (special school subjects)	367 or 12,5 %
*	Didactics (general)	240 or 8,2 %
*	Physical Education/Science of Human Kinetics	215 or 7,3 %
*	Administration of education	209 or 7,1 %

TABLE 2: DIVISION OF RESEARCH FOR DEGREE PURPOSES AND NON-DEGREE PURPOSES PER ORGANIZATION

	PURPOSE OF RESEARCH																
ORGANIZATION	NDP	D.Ed.	D.Ed.Ph.	D.Ed. (Psych.)	D.Phil.	D.Sc.	Ph.D.	Ph.D. (P.Ed.)	M.in P.Ed.	M.A.(P.Ed.)	M.Ed.(P.Ed.)	M.P.Ed.	M.Ed.	M.Ed. (Psych.)	M.(Phil.)	M.A.	M.Sc.	TOTAL
BAYLOR UNIV	4																	4
INTERN COLOURED	1																	1
GOK	3																	3
JCE	2																	2
CHAMBER OF MINES	1																	1
CPED	14																	14
NAT CULT MUS	1																	1
NED	12																	12
NTC	2																	2
OGR	1																	1
ONDERWKOL PRET	1																	1
ONDERWKOL POTCH	3																	3
OFSED	6																	6
PCE	1																	1
PU FOR CHE	16	81			8	2						1	118			9	2	237
HOUSE OF DEL	16																	16
HOUSE OF REP	9																	9
RAU	25	33			1								205					264
HSRC	240																	240
RHU	5						5						18			5		33
SCE	2																	2
TED	2																	2
UCT	2						7						15		6			30
UD-W	6	8								1			18			1		34
UFH	9												8			1		18
UN	3	1			1		14						48					67
UNIN	4	8											16					28
UNISA	9	217											377					603
UNIV BATH													1					1
UOFS	68	71			3					16			134			1		293
UP	84	102		1	5					32	1		249	4		3		481
UPE	10	26					1						66			1		104
US	23	53	1				3	8	30				142					260
UWC	2	7											19					28
UZ	4												2					6
S FOR CHE	4																	4
WITS	7						14						98					119
ISCOR	1																	1
TOTAL	603	607	1	1	18	2	44	8	30	49	1	1	1534	4	6	21	2	2932

TABLE 3: DIVISION OF BROAD FIELDS OF STUDY PER ORGANIZATION

	STUDY FIELD																						
ORGANISATION	ADMIN. OF EDUCATION	GENERAL	EXTRA CURRICULAR ACTIVITIES	DIDACTICS (SPEC. SCHOOL SUBJECTS)	DIDACTICS GENERAL	EDUCATIONAL PHILOSOPHY	HISTORICAL EDUCATION	CURRICULUM PLANNING	PHYSICAL EDUCATION	MEDIA CENTRE	RESEARCH METHODOLOGY	INSTRUCTION & TEACHER TRAINING	NON-FORMAL EDUCATION	TEACHING PROFESSION	EDUCATION STATISTICS	ORTHOPEDAGOGICS	PRIVATE EDUCATION	PSYCHOPEDAGOGICS	PRINCIPAL	SCHOOL GUIDANCE	SOCIOPEDAGOGICS	COMPARATIVE EDUCATION	TOTAL
BAYLOR UNIV					1										1	1		1					4
INTERN COLOURED																		1					1
GOK					1	1												1					3
JCE				1								1											2
CHAMBER OF MINES									1														1
CPED	4	3		2			2			1				1								1	14
NAT. CULT. MUS.		1																					1
NED	4			2	3			3															12
NTC	1											1											2
OGR		1																					1
ONDERWYSKOL. PRET									1														1
ONDERWYSKOL. POTCH												1				1		1					3
OFSED	4								1													1	6
PCE					1																		1
PU FOR CHE	12	3	3	26	11	36	10	3	36			5		2	1	12		39	3	13	2	11	237
HOUSE OF DEL	4				1				2						1			3			1	4	16
HOUSE OF REP	4			1	1			1				1						1					9
RAU	25	1	1	27	30	21	1	15	1		1	22	4	13		5		62	6	18	6	3	284
HSRC	31	6	1	26	24	7		10	21			5	1	3	6	6		33		41	3	16	240
RHU	1		1	2	1	2	1	1	10			1		2			1	6		2	1	1	33
SCE				1	1																		2
TED	1			1																			2
UCT	1			3	2	2	4	1				5	1			1		3	1			2	30
UD-W	3			1	2	1	1	1	6				3					12		1		3	34
UFH	1			7	1		1					5						2				1	18
UN	5	2		14	3	1	8	1				7	2	2		2		9		1	1	9	67
UNIN	3			5		1	5	1	2			1						4			1	5	28
UNISA	27	5		71	61	157	51	14	2		1	12	3	8		17		142		15	6	31	603
UNIV. BATH												1											1
UOFS	37		1	41	20	25	15	5	24	1	1	1	2	3	35	7		40		6	6	12	293
UP	15	1		32	62	14	9	10	57	1	5	9	2	4		58		99		37	11	15	481
UPE		1		19	8	32	7	7	6			2	1	1		9		22		1	2		104
US	20	1	1	50	30	16	16	5	84	1		6	5	5		5		34		2	3	6	260
UWC	1			4			4		2							1		7			7	2	28
UZ					1	1												2					6
S FOR CHE				1	1	2																	4
WITS	6			11	10	17	11	2	1			8	2	3		4		30		6	4	5	119
ESCOR				1																			1
	208	25	10	387	240	384	150	76	215	4	9	96	25	47	44	129	1	554	10	145	54	138	2932

Together these six fields of study represent 1 979 or 67,5 % of the total. The remaining 16 fields thus produced a mere 32,5 % of the total research output. It would appear that at UNISA, for example, 299 research studies out of 603 (or 49,6 % of the research) were in the fields of educational philosophy or psychopedagogics. It further seems that 35 out of the 44 (79,5 %) studies on educational statistics were pursued at UOFS, which is significant for the prospective student. At UP 58 out of the 129 (45 %) studies were in the field of orthopedagogics. This grouping of subject fields is extremely broad and does not do justice to the wide range of themes researched; nevertheless it provides a broad classification without which, if the titles alone were considered, it would be impossible to obtain a global view. The *status* quo of the information and its arrangement, however, raises the question of balance in the research. A further question that arises is whether the research is sufficiently practice-oriented for a country facing numerous challenges - as mentioned above.

In the discussion of Tables 1 and 2 it was mentioned that only 89 post-graduate studies in Physical Education were undertaken. However, the above list indicates that 215 research documents or reports were completed. Further investigation revealed that in the field of physical education, research was spread over 13 degree courses, as well as being conducted for non-degree purposes. Apart from NDP (N = 69), most research documents or reports were produced for the degrees M.A. (Phys.Ed.) (N = 49), M. in Physical Education (N = 25), M.A. (N = 16), M.Ed. (N = 15), and D.Phil. (N = 13).

The research output of the divisions within particular institutions are considered in Table 4. In terms of research output, it is evident that the departments/divisions of universities have the largest output of research with 2 605 or 88,8 % of the total of 2 932 research studies. This is followed by research reports of various other organisations, including institutes of the HSRC with 247 or 8,4 % of the total. These "other" organizations exclude universities, education departments and colleges of education. Research reports by education departments (those actually presented for inclusion in the data base) represent 60

TABLE 4: RESEARCH FOR DEGREE PURPOSES AND NON-DEGREE PURPOSES PER DIVISION/DEPARTMENT OF ORGANIZATION OR INSTITUTE

ORGANIZATION	DEPARTMENT																					
	GENERAL	INDUSTRIAL PSYCHOLOGY	HSRC							DIDACTICS AND SUBJECT DIDACTICS	EMPIRICAL EDUCATION	ENGLISH	EDUCATIONAL PSYCHOLOGY	SPECIAL EDUCATION	HISTORICAL AND COMPARATIVE EDUCATION	IPR	ICAG	ILT	ISER	ISRT	CHILD GUIDANCE INSTITUTE	SCIENCE OF HUMAN KINETICS
			NIPR	IMLED	ILLA	IER	IPMR	IRSRD	SAPMB													
Departments of Education	1																					
Colleges of Education	15																					
Universities	4	1								511	149	1	898	7	182	1	3	5	4	8	5	175
Overseas Universities	5																					
Other bodies	6		14	34	1	149	1	2	39													
TOTAL	31	1	14	34	1	149	1	2	39	511	149	1	898	7	182	1	3	5	4	8	5	175

ORGANIZATION	LINGUISTICS	MARKET RESEARCH	METHODOLOGY	RESEARCH UNIT	NON-FORMAL PROVISION OF EDUCATION	ENVIRONMENTAL UTILIZATION	EDUCATION AND CULTURE	EDUCATION MANAGEMENT	EDUCATION BUREAU	DIDACTICS	ADMINISTRATION OF EDUCATION, COMPARATIVE AND HISTORICAL EDUCATION	PERSONNEL RESEARCH	PROFESSIONAL TRAINING OF TEACHERS	PSYCHO- AND SOCIOPEDAGOGICS	PSYCHOLOGICAL SERVICES	SCHOOL GUIDANCE	SPORT BUREAU	STUDENTS SERVICE BUREAU	LANGUAGE METHODOLOGY	TERTIARY DIDACTICS	URBAN PROBLEMS RESEARCH UNIT (UPRU)	COMPARATIVE EDUCATION AND EDUCATION MANAGEMENT	ANTHROPOLOGY	GUIDANCE AND ORTHOPEDAGOGICS	LEISURE TIME STUDIES	PHILOSOPHICAL PEDAGOGICS AND ANDRAGOGICS	T O T A L
Departments of Education							25		33						1												60
Colleges of Education																											15
Universities	1	1	1	4	1	3		88		37	41		6	306		9	8	37	1	13	1	6	1	62	1	23	2605
Overseas Universities																											5
Other bodies												1															247
TOTAL	1	1	1	4	1	3	25	88	33	37	41	1	6	306	1	9	8	37	1	13	1	6	1	62	1	23	2932

* Explanation of abbreviations

IPR = Institute for Planning Research
ICAG = Institute for Child and Adult Guidance
ILT = Institute for Language Teaching
ISER = Institute for Social and Economic Research
ISRT = Institute for Sport Research and Training

out of 2 932 or approximately 2,0 % of the total. Colleges of education conducted only 15 studies or 0,5 % of the research. However, it should be borne in mind that the staff of colleges of education, as well as those of departments of education, continue their studies at universities and their research output therefore forms part of the research for degree purposes at universities. At departments of education there are possibly some internal reports that are not made available externally for inclusion in data bases. The table further reveals that Departments of Philosophy of Education (N = 898), Didactics and Subject Didactics (N = 511), as well as Psycho- and Sociopedagogics (N = 306), undertake the greatest number of research studies and dominate the research output.

In Table 5 the research of universities is indicated per division. Trends regarding the most dominant study fields are again confirmed. Education evidently does not attract as many students at the English universities as it does at the Afrikaans universities. The research output at the English universities is therefore correspondingly lower.

The research output of the departments of education is indicated in Table 6 and probably reflects only those investigations made public.

Table 7 shows the research undertaken at colleges of education.

Finally, the other institutions that undertake educational research are shown in Table 8. Of these institutions the HSRC (more particularly its Institute for Educational Research) produces the largest contribution, namely 149 out of 247 studies, or 60,3 % of the total.

TABLE 5: RESEARCH AT UNIVERSITIES PER DIVISION

Universities	DIDACTICS AND SUBJECT DIDACTICS	PHILOSOPHY OF EDUCATION	SCIENCE OF HUMAN KINETICS	ENVIRONMENTAL UTILIZATION	EDUCATION MANAGEMENT	PSYCHO- AND SOCIOPEDAGOGICS	SPORT BUREAU	HISTORICAL AND COMPARATIVE EDUCATION	GUIDANCE AND ORTHOPEDAGOGICS	LEISURE TIME STUDIES	ICAG	SCIENCE OF TEACHING	TERTIARY DIDACTICS	METHODOLOGY	URBAN PROBLEMS RESEARCH UNIT	ENGLISH	ISER	EMPIRICAL EDUCATION	GENERAL	LANGUAGE METHODOLOGY	MARKET RESEARCH	STUDENTS' SERVICE BUREAU	COMPARATIVE ED. & ED. MANAGEMENT	INDUSTRIAL PSYCHOLOGY	ANTHROPOLOGY	PHILOSOPHICAL PEDAGOGICS & ANDRAGOGICS	ISRT	CHILD GUIDANCE INSTITUTE	RESEARCH UNIT	PROVISION OF NON-FORMAL EDUCATION	SCHOOL GUIDANCE	IPR	PROFESSIONAL TEACHER TRAINING	ILT	ADMIN. OF ED./COMP. & HIST. PED.	SPECIALIZED EDUCATION	LINGUISTICS	TOTAL
PU for CHE	15	65	30	3	32	30	8	26	27	1																												237
RAU	15	203									3	37	6																									264
RHU		21	11														1																					33
UCT		28												1	1																							30
UD-W	3	7	6			9		3					3			1	2																					34
UFH	14	3																1																				18
UN		63				4																																67
UNIN	3	6	2					11										4	1	1																		28
UNISA	184	198						53	10									144			1	7	6															603
UOFS	79	14	24		56	52		41					1				1							1	1	23												293
UP	77	94	49			133		45	25										1			30					8	5	4	1	9							481
UPE	29	34	4			30																										1	6					104
US	91	34	47			38							3						1															5	41			260
UWC	1	14	2			9		2																														28
UZ		4				1		1																														6
WITS		110																	1																	7	1	119
TOTAL	511	898	175	3	88	306	8	182	62	1	3	37	13	1	1	1	4	149	4	1	1	37	6	1	1	23	8	5	4	1	9	1	6	5	41	7	1	2605

TABLE 6: RESEARCH AT DEPARTMENTS OF EDUCATION PER DIVISION

DEPARTMENT OF EDUCATION	GENERAL	EDUCATION BUREAU	PSYCHO-LOGICAL SERVICES	EDUCATION AND CULTURE	TOTAL
CAPE PROVINCIAL EDUCATION DEPARTMENT		13	1		14
NATAL EDUCATION DEPARTMENT		12			12
ORANGE FREE STATE EDUCATION DEPARTMENT		6			6
TRANSVAAL EDUCATION DEPARTMENT		2			2
HOUSE OF DELEGATES				16	16
INTERNAL AFFAIRS COLOUREDS (DOES NOT INDICATE DIVISION)	1				1
HOUSE OF REPRESENTATIVES				9	9
TOTAL	1	33	1	25	60

TABLE 7: RESEARCH AT COLLEGES OF EDUCATION PER DIVISION

COLLEGES OF EDUCATION	GENERAL
GOUDSTADSE ONDERWYSKOLLEGE	3
JOHANNESBURG COLLEGE OF EDUCATION	2
NATAL TRAINING COLLEGE	2
PRETORIA COLLEGE OF EDUCATION	1
OPLEIDINGSKOLLEGE GRAAFF-REINET	1
ONDERWYSKOLLEGE PRETORIA	1
ONDERWYSKOLLEGE POTCHEFSTROOM	3
SPRINGFIELD COLLEGE OF EDUCATION	2
TOTAL	15

TABLE 8: RESEARCH AT OTHER* INSTITUTIONS THAT UNDERTAKE EDUCATIONAL RESEARCH

OTHER INSTITUTIONS	GENERAL	BRSS	INLER	IRLA	IER	IPER	ISODEM	SAPRHS	PERSONNEL RESEARCH	TOTAL
CHAMBER OF MINES	1									1
NAT. CUTL. MUS	1									1
HSRC		14	34	1	149	1	2	39		240
S FOR CHE	4									4
ISCOR									1	1
TOTAL	6	14	34	1	149	1	2	39	1	247

* Institutions other than universities, departments of education and colleges for education

5. CONCLUSION

While it must be stressed once again that this information should not be interpreted in absolute terms - owing to the factors previously mentioned - NAVO data base of the Institute for Research Development certainly contains sufficient information to highlight some trends in educational research. While research is clearly undertaken over the broad spectrum of education, it is also apparent that certain directions are particularly dominant and the question can be raised as to whether practice-oriented research receives sufficient attention and is given the right priority. The research agenda in education should be considered afresh bearing in mind the development problems of the RSA and the need to expand the provision of education and in some cases to upgrade it.

REFERENCES

COMMITTEE OF UNIVERSITY PRINCIPALS. Macro-aspect of the university within the context of tertiary education in the RSA. Report of the Main Committee of the CUP investigation. Pretoria: December 1987

COMMITTEE OF UNIVERSITY PRINCIPALS. Main trends in the tertiary education sector in the RSA during the past two decades in respect of matters such as student numbers, personnel provision, financing and relative remuneration of university personnel. Question 4. Pretoria: 1987.

HUMAN SCIENCES RESEARCH COUNCIL. Printout of the NAVO data base from the sixties to the end of September 1986. Pretoria: HSRC, 1986.

42

APPENDIX 1

EXPLANATION OF ABBREVIATIONS AND SYMBOLS USED IN THE TABLES

1. ORGANIZATIONS

1.1 DEPARTMENTS OF EDUCATION

CPED	Cape Provincial Education Department
NED	Natal Education Department
OFSED	Orange Free State Education Department
TED	Transvaal Education Department
HOUSE OF DEL.	House of Delegates
INTERN. COLOURED	Internal Affairs Coloureds
HOUSE OF REP.	House of Representatives

1.2 COLLEGES OF EDUCATION

GOK	Goudstandse Onderwyskollege
JCE	Johannesburg College of Education
NTC	Natal Training College
PCE	Pretoria College of Education
OGR	Opleidingskollege Graaff-Reinet
ONDERWKOL. PRET	Onderwyskollege Pretoria
ONDERWKOL. POTCH	Onderwyskollege Potchefstroom
SCE	Springfield College of Education

1.3 UNIVERSITIES

PU for CHE	Potchefstroom University for Christian Higher Education
RAU	Rand Afrikaans University
RHU	Rhodes University

UCT	University of Cape Town
UD-W	University of Durban-Westville
UFH	University of Fort Hare
UN	University of Natal
UNIN	University of the North
UNISA	University of South Africa
UOFS	University of the Orange Free State
UP	University of Pretoria
UPE	University of Port Elizabeth
US	University of Stellenbosch
UWC	University of the Western Cape
UZ	University of Zululand
WITS	University of the Witwatersrand

1.4 OVERSEAS UNIVERSITIES

BAYLOR. UNIV	Baylor University
UNIV. BATH	University of Bath

1.5 OTHER BODIES

CHAMBER MINES	Chamber of Mines
NAT. CULT. MUS.	National Museum of Cultural History
HSRC	Human Sciences Research Council
S. FOR CHE	Society for Christian Higher Education
ISCOR	South African Iron and Steel Corporation

FLUCTUATION ANALYSIS: A PROPOSED EDUCATIONAL EXPERIMENTAL DESIGN

A.W. DROST

1. INTRODUCTION

1.1 EXPERIMENTAL AND CONTROL GROUPS IN EDUCATIONAL EXPERIMENTS

In a scientific laboratory it is possible to pair off experimental and control samples for experiments precisely, both in respect of quality and of quantity. However, when one plans educational experiments with pupils, this pairing off of experimental and control groups is considerably more problematic. In Paragraphs 1.5 to 1.11 we shall discuss a few of the problems encountered in this regard.

In Paragraph 3 of this article an experimental procedure (referred to as fluctuation analysis) is proposed by means of which an attempt is made to avoid the dilemma of comparable experimental and control groups in educational experiments to a certain extent by comparing pupils only with themselves.

1.2 THE INCENTIVE FOR DESIGNING FLUCTUATION ANALYSIS

During 1981 the HSRC was requested to do an experimental evaluation of a series of video films. These films had been produced to aid instruction in three of the subjects for which a serious shortage of sufficiently qualified teachers existed, namely Mathematics, Biology and Physical Science.

As the first proposed experiment which would have involved the testing of the films at a large number of schools was unfeasible, a request was made to test them on a smaller scale by making use of experimental and control groups in order to determine whether pupil achievement was likely to improve significantly as a result of their use.

An analysis of the pupil population and the qualifications of teachers involved in teaching the three mentioned subjects to Standard 9 pupils at schools in the Pretoria and Johannesburg areas, revealed that it would be extremely difficult to put together comparable experimental and control groups. The solution to this dilemma was the designing of a quasi-experimental technique, which later became known as fluctuation analysis.

1.3 THE USUAL APPEARANCE OF AN EDUCATIONAL EXPERIMENT

The design of an educational experiment may be described as follows:

Basically the experimental design consists of two groups of pupils being used for an investigation. For some time one of these groups (the experimental group) is subjected to an independent variable while the other (the control group) is not subjected to this variable. Subsequently the differences between the two groups are analysed and any significant differences are ascribed to the independent variable. Understandably any such differences may only be ascribed to the independent variable if various criteria were strictly adhered to. These criteria all have a controlling nature and can therefore be used to control the validity of the experiment (according to Oosthuizen 1975:33).

Landman *et al*. (1980:73) state that the educational experiment means that formal, systematic and intensive scientific experiments are conducted with a view to increasing our knowledge of the reality of education without attributing to the child the qualities of a rat or an ape, or mechanizing him, or by behaving in any way that could affect his dignity.

1.4 WHY EDUCATIONAL EXPERIMENTS ARE OFTEN ESSENTIAL

Landman *et al*. (1980:73) describe the purpose of educational experimenting as follows:

An educational experiment can be described as an experiment conducted to confirm something that is pedagogically significant while at the same time revealing the true value, or lack of value of the educationally meaningless. Here we are concerned with particular research actions that have to function within the reality of education in which the dignity of the child being educated must be given priority in terms of educational aims and according to anthropological guidelines.

When a particular teaching strategy (for example the application of a specific medium such as video, computers or a specific textbook) has to be tested experimentally (scientifically), the implication is that this testing can only be scientific if conducted by means of grouping the learners to form experimental and control groups.

1.5 FACTORS HAMPERING COMPARABLE EXPERIMENTAL AND CONTROL GROUPS IN EDUCATIONAL RESEARCH

By means of pairing off or randomness it is possible to achieve a fairly acceptable division of pupils into experimental or control groups. Pairing off is usually based on factors that may influence the end result. However, it is impossible to identify all such factors. Furthermore the possibility of unpredictable interactions between various factors can further complicate the designing of any educational experiment.

Unlike the case of the natural sciences where experimental conditions can be controlled fairly accurately, experiments involving persons and groups of persons are characterised by an ever-present accumulation of uncontrollable and even indescribable extraneous variables brought about by man's unique ability to transcend himself (referred to as "Dasein" by Heidegger 1926), in other words, to travel mentally to far beyond the boundaries of physical limitations. It is precisely this ability that enables man to triumph over desperate physical circumstances. This unique quality often results in the unpredictable disrupting of controlling experimental limitations (by man as the subject being controlled).

1.6 EXPERIMENTAL CONTROLS ARE DIFFICULT TO EXECUTE

In research practice it is not easy to comply with the controlling criteria. De Wet *et al.* (1981:86-91) point out various factors (such as historical factors, maturing, testing, changes in measuring instruments and testers, statistical regression, selection, loss of test persons and interaction between combinations of factors) that may threaten the internal validity of the experimental control. The external validity of experimental control, on the other hand, is threatened by factors such as population validity and ecological validity (influenced by the definition of variables, the Hawthorne effect, novelty, influence exercised by the person conducting the experiment and the effect of preliminary tests and the final test).

1.7 EXPERIMENTS INTERFERE WITH LESSONS

If one considers that educational researchers usually have to rely on the co-operation of teachers who have a large number of students to account for and who are expected to progress according to busy schedules, the interests of experimental controls can quite easily clash with educational interests in the classroom situation.

The general assumption is that the time available for instruction is limited as it is and that it is impossible to set aside any time for the experimental manipulation of groups of pupils. (For this reason an attempt is made in the proposed technique of fluctuation analysis to cause the least possible disturbance in the normal course of classroom activities.)

1.8 THE DENIAL OF USEFUL LEARNING OPPORTUNITIES MAY HAMPER THE PROGRESS OF CERTAIN PUPILS

Every teacher has a duty to apply all the available means to assist the development of every individual child in his/her care. It would therefore be contrary to the educational ideal to expect a teacher to deny certain pupils access to an available and potentially positive learning influence for the sake of a scientific experiment. (In the proposed fluctuation analysis division all pupils eventually benefit from all the available opportunities. The condition is merely that during the period of testing a certain group of pupils should be exposed only to a limited number of these opportunities. Once testing has been completed, all the pupils will be free to utilize all the available opportunities.)

1.9 EDUCATIONAL MEDIA AND THE WAYS IN WHICH THEY ARE IMPLEMENTED ARE MUTUALLY INTERTWINED

Literature on the subject shows that in practice it is impossible to separate the effect of a specific educational medium on learning from its implementation.

"A common report among experimenters is that they find more variance within that between media - meaning that learning seems to be affected more by what is delivered than by the delivery system" (Schramm 1977: 273).

A particular teaching strategy will be implemented in a unique way by a certain teacher. This applied strategy, combined with its implementation by the specific teacher is unique and should be evaluated as a whole.

1.10 EVERY LEARNER IS A UNIQUE PERSON

A conventional experimental design (for instance for the testing of an experimental teaching strategy) traditionally involves an experimental group of learners and a comparable control group. The comparability of these two groups can be determined by a preliminary test.

However, if one considers that every learner is a unique person, it is clear that the comparability of only two learners is not altogether reliable. Furthermore, if one considers that a specific group of pupils being taught by a unique teacher constitute a unique, non-repeatable grouping in time and space, it becomes clear that any attempt at dividing them into so-called "comparable learner groups" is based on an oversimplification of the reality of life. Mouton (1984:5) warns against such shortsightedness and the inadmissability of such oversimplifications in research conducted in the field of the human sciences.

1.11 UNEQUAL TREATMENT OF PUPILS CAN LEAD TO REACTIVE BEHAVIOUR

Giving certain pupils (an experimental group) in a school access to a potentially useful or stimulating teaching aid (e.g. a series of films) while withholding it from others (the control group) might give rise to a feeling of dissatisfaction among pupils, causing them to act unnaturally in experimental situations. It is therefore desirable that all pupils in a particular standard should receive the same treatment.

2. MOTIVATION FOR THE FLUCTUATION ANALYSIS TECHNIQUE

2.1 IT IS THE LESSON CONTENTS RATHER THAN THE PUPILS THAT SHOULD BE TREATED EXPERIMENTALLY

The method of fluctuation analysis explained below suggests that all pupils in a specific standard in a school should be exposed to exactly the same learning experiences while certain *themes for lessons* should rather be treated experimentally. The differences revealed by individual learners in respect of their measured learning achievement in themes treated experimentally, compared to achievement in respect of themes given control treatment, can then serve as the measurable dependent variable. In other words, the lessons rather than the pupils are used experimentally.

This subtle modification is aimed at achieving a greater measure of sensitivity towards the learner as a unique person.

2.2 MASTERING OF TESTS CAN BE MEASURED BY MEANS OF MULTIPLE-CHOICE TESTS

Carefully designed multiple-choice tests make it possible to test a learner's knowledge of various subjects (themes) by means of a single series of questions.

A multiple-choice test consisting of 60 questions can for instance cover six different subjects (ten questions on each). By further expanding the test, making it a *sequence preference test* (in which the pupil has to arrange the remaining distractors in a specific order, e.g. from the second best to the poorest solution for a problem) more reliable scores can be obtained. An analysis of a learner's achievement in tests of this nature can indicate the degree to which he/she had mastered each theme.

2.3 TWO TEACHING STRATEGIES CAN BE COMPARED IN A FOUR-BY-FOUR DESIGN

When a number of subsequent themes which do not progressively follow on one another are presented alternately according to two different teaching strategies, these teaching strategies can be set off against one another by studying the pattern of fluctuation of pupil achievement in respect of the various themes.

In order to compensate for variations in the degree of difficulty it is suggested that the pattern of teaching strategies should be reversed in a second school, while in a third school only one and in a fourth school only the other strategy should be used. In practice this could quite easily be achieved by alternately and successively introducing a specific educational aid programme (itinerant hardware and software) to a number of schools in the same area. The fluctuation patterns revealed by the scores of individual pupils, analysed accumulatively for all four schools, can then be used to indicate the relative effectiveness of the two teaching strategies that were compared.

3. HOW DOES FLUCTUATION ANALYSIS FUNCTION?

The technique of fluctuation analysis is based on a group of learners receiving a limited number (e.g. four) experimental and control lessons in different parts of their syllabus. This is followed by a test by means of which both the lesson content that was treated experimentally and a comparable quantity given control treatment are tested simultaneously by means of the same number of questions.

The questions pertaining to those lessons that were treated experimentally are interspersed with an equal number of questions on the control lessons. Subsequently each learner's score for work that was treated experimentally is compared to scores obtained for an equal number of questions on lessons for which the control method had been used.

The extent to which the performance of individual learners in respect of questions on experimental themes differ from their performance in respect of questions on control themes is aggregated for the entire class group in order to arrive at a quantitative indication of the influence of the experimental programme on the performance of the group as a whole.

The underlying principle on which fluctuation analysis is based can be formulated in the following four steps:

Step 1: If a group of learners have completed two comparable lessons according to two different teaching strategies, referred to as A and B, and Method A is more effective than Method B, it is to be expected that a learner will score better marks for questions set on work taught according to Method A than he/she will score for the same number of questions on work taught according to Method B.

Step 2: If the achievement tendency of the entire group of learners in respect of questions set on work taught according to Method A is generally better than its corresponding achievement tendency in respect of work taught according to Method B, it is strongly indicated that Method A is more effective than Method B.

Step 3: If on the whole this difference in respect of the achievement tendency in favour of Method A occurs consistently in an altogether different group of learners who were taught opposite halves of the work according to Methods A and B, it would be safe to assume that Method A is most probably better than Method B.

Step 4: The extent to which Method A is better than Method B can be measured by comparing the score distribution for work taught according to Method A with that for work taught according to Method B.

The statistical significance of this difference in score distribution is calculable.

Paragraph 6 contains a hypothetical example of the application of fluctuation analysis to an experimental result.

4. WHEN IS FLUCTUATION ANALYSIS SUITABLE AS A METHOD OF EVALUATION?

4.1 WHERE THE AVAILABLE EXPERIMENTAL GROUPS ARE SMALL

Where the class groups of learners in potential experimental schools close enough to a researcher's headquarters to make research convenient and economically feasible consist of more or less 30 pupils, there would not be enough pupils to form both experimental and control groups of statistically satisfactory sizes within the class groups. Furthermore the disruption that such a division would cause in the lesson schedule would probably make such a division impracticable.

Possible convenient class groups in the same or different schools that could be involved in an experimental programme may differ so much that a comparison between the experimental and the control group will not produce a reliable result.

4.2 WHERE IT IS DIFFICULT TO CONTROL INTERFERENCE FACTORS AND INDIVIDUAL DIFFERENCES

In any investigation involving an experimental group and a control group the elimination of interference factors creates a problem, as does the comparable pairing off of these two groups. In a fluctuation analysis framework (see Table 1) containing four dissimilar groups of equal size (e.g. 20 individuals per group) the role played by individual differences, group differences and interference factors is insignificant as the achievements of every learner are compared only with his own previous achievements. This means that every learner belongs to both the experimental and the control group so that any interferences influencing the individual, influence the experimental and control results to an equal extent.

4.3 WHERE IT IS NECESSARY TO EVALUATE INDIVIDUALIZED INSTRUCTION STRATEGIES

Due to the fact that Computer-Assisted Instruction (CAI), represents an individualized instruction strategy, a conventional experiment is not really suitable for its evaluation. If a school possesses only one microcomputer (the cheapest possible provision of CAI) or perhaps a few, and a class group consists of for instance 20 pupils, individual students will be exposed to CAI for short periods only (e.g. 10-15 minutes each if they take turns when given time for self-activity during a normal period). By measuring the learning effect of the available CAI programmes for statistically valid numbers of test persons, the evaluation of CAI as an instruction strategy in such a school will necessarily require a considerable implementation period during which the possibility of interference factors influencing experimental treatment will be increased considerably.

In a fluctuation analysis framework, as described in the following paragraph, the fact that every test person together with all the possible interference factors that may influence him/her, contributes in equal measure to both the experimental and the control result, compensates for the presence of interference factors.

5. A FRAMEWORK FOR FLUCTUATION ANALYSIS

The four-group framework shown in Table 1 represents the simplest experimental fluctuation analysis framework for achieving the highest possible number of controls by means of compensation.

HSRC Report O-165 (Drost *et al.* 1983:7) expounds the research need and the subsequent mental experiment that led to the development of the technique (later named fluctuation analysis) and describes actual results measured in this way.

The four-group framework was designed to alternate an experimental treatment of specific themes with a control treatment of an equal quantity of other themes for a total experimental subject population divided into four isolated and dissimilar groups.

As shown in Table 1, Learner Groups I and II represent a comparable distribution of the experimental and the control treatments. By including score fluctuations for learner groups receiving the same treatment as Groups III and IV in Table I it is possible to compensate for the differences in the degree of difficulty of the various themes and their accompanying tests.

TABLE 1

THE SIMPLEST FOUR-GROUP EXPERIMENTAL FRAMEWORK FOR THE APPLICATION OF FLUCTUATION ANALYSIS

Key: * indicates experimental treatment
- indicates control treatment

Learner groups	Themes (mutually independent)			
	A	B	C	D
I	*	-	*	-
II	-	*	-	*
III	-	-	-	-
IV	*	*	*	*

NB There are equal numbers of experimental and of control treatments.

TABLE 2

EXTENDED FLUCTUATION ANALYSIS FRAMEWORK FOR EIGHT THEMES TESTED IN SIX DISSIMILAR LEARNER GROUPS

Groups Treatment

(* = experimental treatment of theme)

(- = control treatment of theme)

	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Theme 7	Theme 8
I	*	*	-	-	*	*	-	-
II	-	-	*	*	-	-	*	*
III	-	-	-	-	*	*	*	*
IV	*	*	*	*	-	-	-	-
V	-	*	-	*	-	*	-	*
VI	*	-	*	-	*	-	*	-

Each theme is treated according to the experimental method four times.
Four of the eight experimental lessons are presented to each group.

Although Learner Groups III and IV already represent a conventional control and an experimental treatment within the framework, the addition of Group I and II is considered essential for the purpose of random criss-cross compensation for non-controllable interference factors across the framework as a whole.

Within the four-by-four framework every experimental subject contributes four experimental data units, which means that a clear result can be obtained with fewer subjects.

As shown in Table 2 this framework can be extended to cover a larger number of themes. The experiment can thus be controlled internally by making different four-by-four combinations. The following hypothetical example will illustrate the technique more simply.

6. A HYPOTHETICAL RESULT OBTAINED BY APPLYING FLUCTUATION ANALYSIS

Table 3 shows the marks scored by 10 imaginary students in a test consisting of 48 questions dealing with eight themes. Suppose that the group involved had been exposed to a series of experimental lessons dealing with Themes No. 2, 4, 6 and 8. Further suppose that the test contains six questions on each theme. The score (out of 48) of every student for six questions on each of the eight themes is shown (N_k) next to the scores for six questions on each of the eight themes (t_1 to t_8). The gain in score as a result of the experimental treatment accumulates to the value of W for the entire group of pupils (see table 3).

TABLE 3: AN IMAGINARY SCORE LIST FOR TEN PUPILS ($k=1$ to 10) ON EIGHT THEMES ($j = 1$ to 8) TREATED EXPERIMENTALLY (a) AT $j = 2, 4, 6$ AND 8, AND ACCORDING TO THE CONTROL METHOD (b) AT $j = 1, 3, 5$ AND 7

Key:

t_1 to t_8 = score out of 6 for 6 questions on each of the 8 themes
($q=6$) ($m=8$)

$\sum_a t_{ak}$ = total of scores obtained for experimental themes (for (learner No.k)

$\sum_b t_{bk}$ = sum of scores obtained for control themes (for learner No.k)

$$e_k = \sum_a t_{ak} - \sum_b t_{bk}$$

= Learner No.k's score advantage under experimental treatment (can be either positive or negative)

$W = \sum_{k=1}^{10} e_k$ N_k = learner's score out of 48

Score (out of 6):	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	N_k	$\sum_a t_{ak}$	$\sum_b t_{bk}$	e_k
Treatment:	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)				
Learner No.												
k=1	3	4	5	6	2	3	2	2	27	15	12	+3
k=2	4	3	4	6	1	4	2	2	26	15	11	+4
k=3	2	3	1	4	1	4	1	2	18	13	5	+8
k=4	3	2	1	2	1	3	1	4	17	11	6	+5
k=5	2	0	0	1	0	3	0	2	8	6	2	+4
k=6	1	2	1	2	1	2	1	2	12	8	4	+4
k=7	4	5	5	4	4	5	4	6	37	20	17	+3
k=8	4	4	4	4	4	4	4	4	32	16	16	0
k=9	2	4	2	4	2	4	2	4	24	16	8	+8
k=10	6	6	5	6	5	6	6	6	46	24	22	+2

(There are q questions on each of m themes)

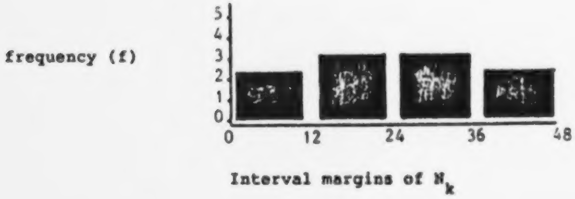
Total: $W = \sum_{k=1}^{10} e_k = +41$

$E = \frac{W}{n} \times \frac{100}{qm} = \frac{+41}{10} \times \frac{100}{48}$ = (average % improvement per learner) = 8,5

An idealized score distribution for the 10 imaginary learners for all the 48 questions together is shown over four intervals in Histogram I.

Histogram I

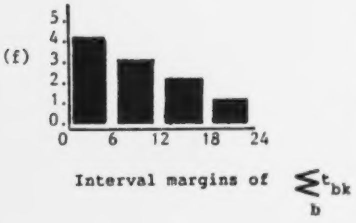
(entire test)



The separate scores of the learner group for the experimental and the control halves of the test are shown below. Histogram II shows the score distribution of the group of 10 students for Themes 1, 3, 5 and 7 jointly (control themes for which no experimental lessons were available) alongside Histogram III which shows the score distribution for Themes 2, 4, 6 and 8, for which experimental lessons were available.

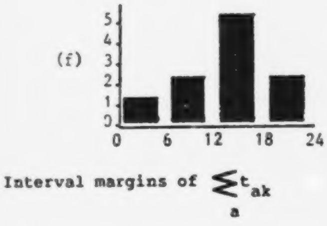
Histogram II

(Control half)



Histogram III

(experimental half)



From these histograms it is evident that in this idealized example the score distribution for the 24 questions on themes to which the experimental method was applied, shows an incline to the right. On the other hand the score distribution for the 24 questions on themes not treated experimentally shows an incline to the left.

In order to quantify the experimental lesson programmes, the so-called "trout method" (Drost et al. 1983:11), described in Paragraph 7, can be used.

7. THE FORMULA FOR FLUCTUATION ANALYSIS

7.1 EXPLANATION OF THE FORMULA

The effectiveness (E) of an experimental learning programme consisting of half the number of m lessons (j = 1 alternating with j = m) applied to a number of pupils (k=1 to k=n) can be calculated as follows on the basis of scores for a test consisting of q questions on each of a total of m themes:

$$E = \frac{\sum_{j=1}^{m} \sum_{k=1}^{n} (-1)^r (m \times t_{kj} - N_k)}{m \times n} \times \frac{100}{q \times m}$$

where t_{kj} = score of Learner No. k for questions on Theme j
and N_k = Learner k's total test score for (q x m) questions
i.e. N_k = number of questions answered correctly by Learner k
(for q questions on each of m themes)

The difference $(m \times t_{kj} - N_k)$ can be either positive or negative.

The value of the exponent r becomes 0(zero) for the one half of the j values where the experimental method was applied;
(If $r=0$, $(-1)^r = (-1)^0 = +1$).

The value of exponent r becomes 1(one) for the other half of the j values where the control method was applied;
(If $r=1$, $(-1)^r = (-1)^1 = -1$).

When a learner (k) improves on his average (N_k) in a theme that was treated experimentally, the formula acquires a positive value for E which represents a credit for the experimental method, while a weaker performance for a theme treated experimentally attaches a negative value to E which represents a debit against the experimental method. Similarly an improved performance in themes to which the experimental treatment was not applied (in such cases the exponent r=1) will also allocate a negative value to E and will therefore constitute a debit against the experimental method (since without it improved performance could not be achieved by the experimental treatment). By considering possible interference factors, for instance differences in respect of the degree of difficulty of the themes and variations in respect of the validity and reliability of test items, it becomes evident that the experimental framework can only be fully compensated by incorporating four groups of pupils into the experimental design.

7.2 SIMPLIFICATION OF THE FORMULA

Consider the formula:

$$E = \frac{\sum_{j=1}^{m} \sum_{k=1}^{n} (-1)^{r} \quad (m \times t_{kj} - N_{k})}{m \times n} \times \frac{100}{m \times q}$$

If the proposed experimental design is applied correctly, the value of $(-1)^r$ will be equal to +1 exactly as many times as it will be equal to -1 and consequently the term $-N_k$ will be cancelled throughout the formula. In addition to this, one factor m can be cancelled in the numerator and the denominator of a formula throughout the entire summation, owing to the distributive characteristic of multiplication over addition.

The formula can therefore be simplified to:

$$E = \frac{\sum_{j=1}^{m} \sum_{k=1}^{n} (-1)^{r} t_{kj}}{n} \times \frac{100}{qm} = \frac{W \times 100}{qmn}$$

The summation factor, summarized as W, can be simplified to:

$$W = \sum_{k=1}^{n} e_k \quad \text{where} \quad e_k = \sum_{a} t_{ak} - \sum_{b} t_{bk}$$

$\sum_{a} t_{ak}$ = Learner No. k's total score for experimental themes

$\sum_{b} t_{bk}$ = Learner No. k's total score for an equal number of control themes.

(See Table 3.)

A complete four-by-four experimental testing would require the testing of learner groups similar to the hypothetical example at four separate locations (without any opportunity for communication with each other). The further summation of the formula across the four groups (1=1 to i=4) results in:

$$E_4 = \frac{\sum_{i=1}^{4} E_i}{4} = \frac{\sum_{i=1}^{4} W_i \times 100}{4qmn}$$

The application of the formula to the ten learners' score sets in the hypothetical example (Table 3) results in the following value for E throughout the entire group:

$$E = \frac{\sum_{j=1}^{8} \sum_{k=1}^{10} (8 \times t_{jk} - N_k)}{8 \times 10} \times \frac{100}{48}$$

which can be simplified to:

$$E = \frac{\sum_{k=1}^{10} \left(\sum_{a} t_{ka} - \sum_{b} t_{kb} \right)}{8 \times 6 \times 10} \times 100$$

$$= \frac{W \times 10}{48} = \frac{+41 \times 10}{48} = +8{,}5 \quad \text{(substitute W from Table 3)}$$

Observation

Compared to their performance in test items on themes No. 1, 2, 3 and 4 (control method), the performance of the ten learners in this example improved by an average of 8,5 % in test items on Themes No. 2, 4, 6 and 8 combined (experimental method).

Conclusion

This improved performance could possibly be attributed to the experimental treatment of the work on Themes No. 2, 4, 6 and 8.

Remark

If this tendency to perform better in test items dealing with themes that were treated experimentally can be maintained by four learner groups of equal size within an experimental framework, with different combinations of four of the eight themes that were treated experimentally, the improved performance can most probably be ascribed to the experimental treatment of the work.

The E-value can therefore only be interpreted after a complete four-group experimental framework as the average percentage improvement per learner resulting from the use of the experimental method.

The question which now arises is: How high should the E value be in order to qualify as a statistically significant improvement?

The answer to this question can be established with the aid of the Wilcoxon rank sign test (Siegel 1956:79&247).

8. APPLICATION OF FLUCTUATION ANALYSIS

During 1982 a number of video films were evaluated by means of a fluctuation analysis framework (Drost et al. 1983:15-48). These films had been produced specifically as instructional aids for the teaching of Mathematics, Biology and Physical Science. The value of the effect of the video films on learner achievement was measured in an experimental design that included four schools for each of the three subjects.

In the case of the films for the teaching of Mathematics the average improvement (calculated on the basis of the results of 104 pupils) was 5,7 %. With the aid of the Wilcoxon rank sign test this improvement was proved to be significant on a 1 % level.

The Biology films, shown to 130 pupils, brought about an average improvement of 2,6 %, proved with the aid of the Wilcoxon rank sign test to be significant on a 5 % level.

The series of films produced for Physical Science, also shown to 132 pupils, brought about an average improvement of 1,6 %, giving them marginal significance on a 5 % level. These quantifications of improvement in achievements, measured where a new instruction strategy (e.g. video films) was used to complement conventional teaching, provided valuable feedback to film producers who could use the information to improve certain films.

It is interesting to note that the series that produced the highest percentage improvement was also judged the best by the didactic evaluators.

Following the application of fluctuation analysis to the evaluation of video films in 1982, this experimental technique was again applied in 1984-85 to the evaluation of programmes for Computer-Assisted Instruction (CAI).

9. CONCLUSION

Together with other evaluation techniques (e.g. didactic evaluation and content analysis), the application of fluctuation analysis in the quantification of the effect of a specific instruction strategy on learning achievement appears to be a useful experimental method for the formative evaluation of newly developed instruction strategies.

REFERENCES

BLOOM, B.S. Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain. New York : David McKay, 1956.

DE WET, J.J. et al. Navorsingsmetodes in die Opvoedkunde. Durban : Butterworth, 1981.

DROST, A.W., LOUBSER, C.P., SWANEPOEL, C.H. The effect of some video programmes on pupil achievement in Mathematics, Biology and Physical Science. Report 0-165. Pretoria : Human Sciences Research Council, 1983.

HEIDEGGER, M. Being and time. (1926) (Translated by, John Macquarrie & Edward Robinson.) Oxford : Basil Blackwell, 1967.

LANDMAN, W.A. (red.) Inleiding tot die opvoedkundige navorsingspraktyk. Durban : Butterworth, 1980.

MOUTON, J. Oor waarheid en objektiwiteit in die geesteswetenskappe. Referaat gelewer by die RGN-gespreksgroep oor Navorsingsmetodologie (14 Augustus 1984 : Pretoria).

OBERHOLZER, C.K. Prolegomena van 'n prinsipiële pedagogiek. Kaapstad : HAUM, 1968.

OOSTHUIZEN, J.D. Spesiale empiriese opvoedkunde. B.Ed. (vraestel 3), Studiegids no. 1. Pretoria : Universiteit van Suid-Afrika, 1975.

SIEGEL, S. Nonparametric statistics for the behavioral sciences. New York : McGraw-Hill, 1956.

SCHRAMM, W. Big media, little media. Beverly Hills : Sage, 1977.

THE LOGO LEARNING ENVIRONMENT IN RESEARCH PERSPECTIVE

A. MULLER

1. INTRODUCTION

If one looks at the subject literature on educational technology and the use of the computer in education today, it soon becomes apparent that the computer language Logo is very much in vogue. Whole editions of publications are devoted to Logo (Byte 7(8), August 1982; The Computing Teacher 10(3), November 1982) with regular articles appearing monthly in many journals. As a hard look at the use of the computer in education is being taken, one can suspect that the last word has not yet been spoken about the sensible use of the computer in education, but at the same time a return to the era before the appearance of the computer in education is hardly feasible.

Part of the fact that Logo is gaining in popularity is that the use of the computer as electronic teaching machine in the drill and practice mode is losing ground (Pinxteren 1984:9). The application possibilities are limited and weaker pupils get to use the computer the most. Pupils get the impression that computers are only meant for less gifted pupils. Logo, it would seem, does present an alternative and is spreading throughout the world. In the USA it has almost become a mania (Pinxteren 1984:9).

The aim of this article is to reflect what benefits are claimed regarding the use of Logo, what research on its use in schools has established, and where further research priorities should lie. An attempt is also made to determine some of the parameters and variables in Logo research.

The following issues are discussed:

- Research on computers in education
- Logo as programming language

- The uses of Logo in education
- The Logo learning environment
- Research findings on Logo
- Problem areas in Logo application
- A number of research questions pertinent to the Logo learning environment
- Logo and research methodology

2. RESEARCH ON COMPUTERS IN EDUCATION

2.1 GENERAL STATUS AND RESULTS

Against the background of problematical research designs, vested interests and the difficulty of controlling a number of variables in education research, Bracey (1982:52) has the following to say about what research shows: "Not nearly as much as it can, will and already should have." About research on computers in education Prentice (1981:88) states the following: "Solid research on the effectiveness of the computer is still sketchy."

In a review of computer-based instruction projects between 1959-1982 Kearsley et al. (1983:90), Prentice (1981:88), and Bracey (1982:52), in his review, identified a number of major outcomes:

- In general it would appear that computers can make instruction more efficient. Results can be placed in three broad categories: achievement, affective/motivational, and social. It can generally be stated that pupils who have been exposed to the computer, as opposed to traditional teaching only, do achieve at higher levels; the computer can accelerate learning in many situations. As far as the affective domain is concerned, it would appear that students at all educational levels are on the whole very positive about working on the computer and enjoy it. About the social outcomes of working on the computer, the research is fairly quiet. It appears that there is an increase in co-operation between pupils in an attempt to solve problems by means of computer programmes.

- Instructional effectiveness is only one dimension of computer use. Of equal significance is the fact that computers can assist in taking a heavy management load off teachers and administrators.

- Not enough is known about the individualization of instruction.

- There is not enough understanding of the instructional variables such as graphics, speech, motion, or humor.

- A lot has been learned about the resistances to innovation in institutions and organizations and resistance to change in the context of implementing computer-based education.

- There has been significant development in the field of authoring tools and techniques.

- Adequate mechanisms have been developed for the dissemination of ideas and courseware. In the RSA these mechanisms have yet to be created.

- Computer-based instruction has stimulated research in the entire field of instruction.

- Government funding has played an important role in the progress made with computer-based instruction projects.

- Much can still be achieved by implementing computers in education.

2.2 FOCUS OF THE RESEARCH

It would seem that most researchers have concentrated on comparing gains in learning by means of computer-assisted instruction (CAI) versus traditional instruction (Bracey 1982: 54). Much research at present is concentrating on why CAI might be more effective (Bracey 1982: 54).

At the moment there is a lack of evaluative case studies examining computer-assisted teaching/learning styles and the types of benefit they can produce (Hartley 1985:140). Current literature on this topic is largely descriptive - case studies of individuals or classes, or details of particular instructional units (Collis 1983: 43).

In 1970 Salomon (in Collis 1983:43-44) distinguished between research *on* instructional media and research *with* media. In research with media the medium is *not* deliberately manipulated to ascertain its instructional effect, that is the medium is approached as a *global entity*. In research on media the cognitive effects of various *modes of presentation* are investigated. "Empirical, controlled research dealing with the cognitive effects of microcomputer use is indeed scarce" (Collis 1983: 43). Virtually only Papert (1980) has provided a theoretical framework in this regard.

2.3 DOMINANT METHODOLOGIES

In the survey of the research on CAI and CMI the following methodologies were found to be dominant (Lawton and Gerschner 1982:51):

- Observation techniques
- Statistical comparison of experimental groups with control groups
- Questionnaires regarding attitudes towards computers in the learning situation

Research findings regarding computer use in special education will not be dealt with here. The reader can however refer to Mojet (1984:94-104).

3. LOGO AS PROGRAMMING LANGUAGE

During 12 years of research, under the direction of Seymour Papert, Logo was developed first in conjunction with a group of researchers at Bolt, Beranek and Newman (a firm of consultants in the human sciences) and from 1970 at the Massachusetts Institute of Technology (Carter 1983:35). Logo is a dialect of LISP, a powerful language developed for research in artificial intelligence (Abelson 1982:88; De Corte 1984:6; Menconi and Richards 1984:18).

Logo programming proceeds in the form of the definition of various procedures. The pupil "speaks" to the computer in words. These words are called primitives and they are the commands which are used. Logo knows almost 100 of these primitives which form the building blocks of the language and enable the user to define new commands.

A "full" Logo consists of turtle geometry, simple arithmetic and list manipulation (Laski 1983:30).

Logo can be regarded as a modern, powerful computer language particularly due to the following characteristics (Harvey 1982:163-165,170, 176; Harvey 1984:52) :

* Logo is an interactive programming language.

* Logo programming proceeds in modular fashion. Subprocedures and modularity, part of the intellectual equipment involved in structured programming (top-down or bottom-up approaches), represent the most powerful ideas that children can learn in Logo (Leron 1985:29).

* The language is extendable in that new primitives can be defined by the user (Carter 1981:49).

* Another feature which makes Logo such a powerful language is the fact that it allows recursion to be executed fairly easily. Recursion in lay terms means repetition - Logo has a programming structure in which part of an instruction in a procedure is the procedure itself. In other words the procedure calls itself during execution of the procedure. This allows problems to be solved in brief but elegant programmes (Carter 1983:37-38).

* Logo is a "list-processing" language. Logo has one structure, the list, for storage and manipulation of all information. This allows the user to organize the data according to his own needs and not solely according to the specifications of the computer language.

A number of versions of Logo are available. Some of these are (Lough 1983-84:30; Martin 1984:54):

* MIT Logo (Terrapin, Krell) for Apple
* CBM Logo for Commodore 64
* Apple (LCSI) Logo
* TRS-80 Color Logo
* IBM PC
** Waterloo Logo
** IBM (LCSI) Logo
** PC Logo
** DR Logo
* TI Logo
* Atari 600, 800XL
* MacIntosh
* Cyberlogo
* Research Machines 380Z and 480Z
* Tandy Color computer

Logo Centre is developing pLogo which will run on any make of computer and will promote standardization and exchangeability of programmes (Pinxteren 1984:9).

The evaluation of various versions of Logo does not fall within the ambit of this article, but the reader is referred to Goldberg (1984), Menconi and Richards (1984), Roth (1984) and Williams (1982).

4. THE USES OF LOGO IN EDUCATION

4.1 LOGO AND MATHEMATICS

Logo was initially envisaged by Papert as an extension and enhancement of learning in Mathematics. It was also regarded as an experience in thinking skills (Papert 1980: Chapters 1 and 2). "Areas where LOGO is useful in mathematics include providing an environment for developing mathematical concepts such as variables; the group properties of numbers; the geometrical concepts of length; angle measure, symmetry, similarity; and co-ordinate systems" (Billstein 1983:36). The introduction to mathematical concepts is rather gradual particularly when turtle graphics are used and figures are defined in procedures. When figures are defined in terms of local changes (as in a circle as a figure with a constant angle) it can form the beginning of differential and integral infinitesimal calculus. The potential of Logo in Maths curricula for high school and college which includes vectors and general relativity theory was demonstrated by Abelson and Di Sessa (in Kunst 1984:46).

4.2 POSSIBILITIES IN OTHER SUBJECTS

Logo has been used by Abelson and Di Sessa to teach Physics to undergraduate students at MIT (in Harvey 1982:186). It has been used in language and music teaching (Papert, Bocker and Fischer, Pinxteren in Kunst 1984:4' Watt 1982:116). Logo also features prominently in computer literacy programmes (Bitter 1982:62; Harvey 1984:53; Watt 1982:116; Zachmeier 1983:8), as an introduction to programming (artificial intelligence, list processing, recursion) (Abelson 1982:90; Harvey 1984:53; Kunst 1984:49; Watt 1982:116), the broader transfer effects of the "powerful ideas", influencing cognitive development and problem solving (Harvey 1984:53; Kunst 1984:49; Watt 1982:116) and influencing pupil attitudes towards computers, Maths, problem solving and learning in general.

With Logo the traditional divide between the expressive and the more exact subjects is narrowed (Pinxteren 1984:8). Graphics in Logo are not simply drawings, but Arithmetic and Maths. Apart from composition, music could also be problem solving, an adventure game is a game but could also be a memory exercise.

Logo has also been used with handicapped pupils (Weir 1981). Radia Perlman created a special keyboard with big keys having pictures on them instead of letters and used Logo with 4-year-old children.

As is evident from the above, Logo is used with very diverse target groups and in different courses at various educational levels.

5. THE LOGO LEARNING ENVIRONMENT

5.1 THE LOGO LEARNING ENVIRONMENT AND DISCOVERY LEARNING

Logo is often described as a programming language. To this Abelson (1982:112) says the following: "Those of us who designed LOGO tend to think of it rather as a computer-based learning environment, where the activities ... are just as integral as the programming tools used (recursion and lists). LOGO is thus more than a programming language - it is also a philosophy of education" (Billstein 1982:18-20; Harvey 1982:188). Riordon (1982:46) defines the Logo learning environment as follows: "It is the entire context, made possible and managed by the teacher, in which students work with LOGO. It is more than a computer learning station. It includes psychological as well as physical space - how students feel, how students and adults interact."

The Logo learning environment has the following characteristics (Riordon 1982):

- Authority is shared between teacher and pupil.
- Sharing and co-operation are encouraged.
- Pupils use one another as legitimate sources of information.
- Pupils choose their own projects and therefore variety rather than uniformity is the norm.
- Rewards are intrinsic.
- Differences in working style are appreciated.
- Learning is shared between pupil and teacher as both often learn together - the teacher is not the sole source of information.
- No evaluation of the pupil's learning is prepared by the teacher for presentation to the pupil or his parents.

5.2 THE ENTRY THRESHOLD TO LOGO

Logo does not presuppose any knowledge of the computer - the entry threshold is very low. At the same time it also offers possibilities to experienced users (Pinxteren 1984:8). The teacher does not require conventional computer programming expertise, but the teacher must be clear about educational aims and learning design (Hartley 1985:141).

5.3 THE ROLE OF THE NATURAL CULTURAL ENVIRONMENT OF THE CHILD

In the natural cultural environment the child gains knowledge by means of the material available. Sufficient concrete material is available in the natural environment for the development of an intuitive concept of numbers (for example one has two feet, two eyes). In this environment the child gains his insights by experiment and in as natural a way as he acquires his mother tongue. This is a far cry from mathematical culture which is not as familiar, and which is very often not positively regarded and imposed by an external agent, the school (Kunst 1984:43). Fundamental changes can be brought about in the development of thought if the culture in which children grow up, can be altered and enriched. Mathematical and procedural thought can be enhanced if children are placed in an environment where mathematical concepts and systematic procedures are present in concrete form (Kunst 1984:43). In this way the divide between the more intuitive and formal mathematical environment can be eliminated. With the aid of computers an environment can be provided in which the child can experience procedures and mathematical concepts in a concrete manner, as the computer "speaks" Mathematics (Papert 1980:47).

5.4 THE COMPUTER, POWERFUL IDEAS, AND COGNITIVE DEVELOPMENT

Although Logo is not based on a particularly sound psychological foundation, it is as well to remember that the ideas behind Logo are generally subscribed to in psychology. These ideas include things such as knowledge being deduced from procedures and action structures, the importance of learner activity in gaining knowledge, and the importance of making problem-solving methods explicit. The foundation can be extended as many contact points with psychology are available (Kunst 1984:49). The appeal in Logo lies not so much in its programming capabilities as in the claim that it is a language for learning how to think (Harvey 1982:178; Tetenbaum and Mulkeen 1984:17).

Although Papert regards programming as an essential part in becoming computer literate, the more fundamental aim is to bring pupils to a better insight in and control over their own cognitive functioning (learning how to think and metacognitive skills), to introduce them to a few _powerful ideas_ which could be called general thought schemes and methods (De Corte 1984:7; Engelbrecht 1983:16; Kearsley _et al_. 1983:92; Papert 1980, Chapters 1 and 2; Tetenbaum and Mulkeen 1984:17). Papert (1980:21) refers to self-referential thinking.

A description in Logo results in materialized activitiy which is closely related to other material actions of the child (Kunst 1984:48). Discussion of Logo procedures enables the expression of intuitive ideas in language which are otherwise difficult to express. The concrete knowledge contains the elements of formal thought. _Powerful ideas_ emerge from concrete experiences one is already familiar with (Carter 1983: 37).

Metacognitive skills play a crucial role in problem solving (De Corte and Verschaffel 1983:451). Metacognitive skills consist of the knowledge the person has of the characteristics, possibilities and limitations of the cognitive functioning of man in general and of himself in particular (Flavell in De Corte and Verschaffel 1983:451). Another aspect of meta-cognition is the ability to reflect upon and guide one's own solving and learning processes (De Corte and Verschaffel 1983:451). By deliberately thinking mechanically as the computer would, the child will learn to distinguish between mechanical thought and formal thought which could promote greater confidence in choosing a cognitive style that is appropriate to the task at hand (Papert 1980:27).

Regarding the cognitive effects of computer use, Pritchard (in Lawton and Gerschner 1982:51) has found that the use of computers for instruction calls for a specific learning style. The following are relevant:

- Manual dexterity at the keyboard
- Attention to detail and accuracy
- Aptitude for visual learning
- A degree of physical passivity and willingness to sit still
- Preference for working alone
- A strong intuitive and diagnostic ability

The environment within which these benefits are to be realized, is a discovery learning environment (Hattingh 1984: 112). The idea in the Logo learning environment is that the computer is not programming the learner (as in CAI) but that the learner is programming the computer (Hattingh 1984:112; Papert 1980:19; Pinxteren 1984:8).

5.5 SYNTONIC LEARNING

A distinction is made between dissociated and syntonic learning (Papert 1980). To learn something by rote as if the material is meaningless is dissociated learning. It is to be distinguished from syntonic learning which is related to the pupil's own realm of experience. In instructing the turtle on the monitor the child is using knowledge of his own body movements. Papert calls this form of learning body syntonic. Dissociated learning estranges the pupil from what he must learn.

5.6 THE MODE AND CONTENT OF THE LOGO LEARNING ENVIRONMENT

Papert bases the philosophy of the Logo learning environment on the work of Piaget. Piagetian learning is the mode and microworlds the content of learning Logo (Leron 1985:26).

5.6.1 Piagetian learning and Logo

Papert spent a number of years working with the Swiss psychologist Piaget who believed that children should play an active role in their learning and in building up their concepts of the world (Papert 1980, Chapter 7; Carter 1983:37; Kunst 1984:47-49). Piagetian learning in Papert's terms refers to the spontaneous way in which the child learns his home language and the turtle geometry by operating spontaneously on the environment. In fact Piaget saw an important relationship between language development and cognitive development in general.

In the place of Piaget's equilibrium process, Papert formulates three basic mechanisms of learning and problem solving which were not adopted from the practice of programming, but which were given concrete form in Logo (Kunst 1984: 47-48):

- The top-down division of a problem into part-problems.
- The bottom-up composition of new procedure modules by co-ordinating existing procedures ("bricolage").
- Debugging.

5.6.2 Microworlds

A key concept in the Logo learning environment is one of microworlds (Papert 1980: Chapter 5). Lawler (1982:139) defines a microworld as a task domain or problem areas designed for real streamlined experience. David (1985:13) defines the microworld as follows: "A programming environment consisting of at the very least, (a) a computer, and (b) a primitive but extensible vocabulary of words that may be used as building blocks in exploring (c) a particular problem area." Powerful ideas should constitute the heart of the microworld. Syntonicity enables ideas to become powerful in the mind. An idea is powerful for a particular person if it creates a unifying relationship between elements of knowledge gained in diverse experiences (Lawler 1982:150). It can be contributed to the presence of learnable powerful ideas that more is learnt in Logo than just programming (Leron 1985:27). Microworld design is a critical area for integrating Logo in the curriculum. Three stages can be discerned in the design of a microworld (David 1985:14):

- (a) Identification of the problem/set of problems you are trying to solve.
  (b) Reduction of the problem to key components.

- Solving any problem with Logo, related or unrelated to the chosen problem area, to establish what Logo can do and to determine how it uses language to make things happen.

- Determining how Logo can be used to define the key components of the chosen problem in terms of what the computer can do. Creating the primitives for this microworld.

Papert (1980: Chapter 5) names four criteria for microworlds:

- Simplicity
- Generality
- Usefulness
- Syntonicity.

5.7 THE LOGO LEARNING ENVIRONMENT AND TRANSFER OF KNOWLEDGE

Much is made of the possibilities of transfer which are believed to be inherent in the Logo learning environment (Kunst 1984:48). The powerful ideas inherent in microworlds can be transferred to other microworlds and can eventually become established principles.

5.8 PREREQUISITES FOR IMPLEMENTING THE LOGO LEARNING ENVIRONMENT

Teachers need to learn the language, the power and limitations of Logo, how the Logo learning environment is to be created and what you may want to do with it in the future (Billstein 1983:36; Riordon 1982:46). Leron (1985:28) supports the idea of training with an expert in the philosophy of Logo. Powerful ideas are not easily learnt and this is essential before a sensible learning environment can be created. The teacher *must* be *au fait* with Logo to be in a position to guide and encourage pupils to prevent frustration setting in when a pupil gets stuck on a problem (Billstein 1983:35). Certainly the teacher must decide whether to adhere strictly to the unstructured approach to using Logo as envisaged by Papert, or whether guided discovery and opportune teacher intervention will best serve the purpose. This particular aspect also has implications for the research methodology chosen, but more about that later.

The interested reader is referred to Riordon's (1982:49-50) description of how to go about creating a Logo environment in class. Torgerson (1983-84:12-14) has also written on the subject of classroom management for Logo.

6. RESEARCH FINDINGS ON LOGO

Before mention is made of some of the research findings, it might be useful to identify some research groups in Logo and the Logo learning environment:

- The most important research centre can be found at MIT (Cambridge, Massachusetts, USA).

- The University of Edinburgh where a more cursory approach is followed with the aid of work sheets. Guided discovery seems to be the dominant approach.

- In the Netherlands a Logo centre was recently formed at Nijmegen. The staff there are very much involved in promoting Logo and organizing research projects and vacation schools.

Evaluation research with regard to Logo is fairly scarce compared with the many publications in which the merits of Logo are proclaimed. Findings are distributed between internal reports of organizations and club publications (Kunst 1984:50). The reader is referred to Reimer (1985:8-9) for an overview of the findings of a number of other projects not described here.

(1) Regarding findings in the cognitive domain Clements (1985:28,74-75) reports cognitive results of two comparable groups of first graders, one being exposed to Logo programming and the other to commercial CAI material. Extensive pretesting and posttesting was done. The Logo group gained on fluency, originality and overall creativity. Their scores on flexibility were not significantly different. In the above skills the CAI group showed no gains. On the whole the Logo group gained significantly more than the CAI group in metacognition. No differences between the groups could be found in the areas of cognitive development and logical thinking. "Thus, there was no evidence that 12 weeks of Logo programming affects cognitive development as compared to 12 weeks of CAI. Rather it may affect the way in which children use the cognitive abilities they possess" (Clements 1985:75).

(2) Papert and his co-workers have largely reported anecdotal material in support of their stand. The information was gathered particularly in the Brookline Project (1977-1978) in which the work of 16 pupils was involved from their sixth year. The Logo learning experience of the group was monitored, the learning style of the pupils and types of choices they made were documented. Some common material and ideas were presented to all pupils and introductory turtle geometry projects were stressed at the beginning of the project. Pupils developed many different Logo projects such as maths quiz, word games and conversations, animations, geometric explorations and action games. During the school year the actual active hands-on experience varied from 20 - 40 hours. The problem-solving and mathematical tests developed by the project staff showed inconclusive results. It appeared that the Logo learning environment was suitable for different kinds of pupils. The gifted and less-gifted pupils were successful in Logo classes. The project was not successful in obtaining objective data about learning gains. Standardized tests were rejected as they were perceived to be irrelevant to the goals of the project (these tests do not measure ability to do turtle geometry). Watt (1982:120) states that educational researchers are not quite *au fait* yet with the development of objective tests for problem-solving and procedural thinking.

(3) A second Brookline Project was undertaken (Watt 1982:122). Computers were placed in classrooms of pupils in grades four to eight. Teachers were provided with a little training and curriculum material was developed for use by pupils and teachers. Two computers were provided for use in the classrooms. Each classroom could use the computer exclusively for 8-12 weeks. Pupils worked on computers individually or in pairs while the rest of the class went on with regular work. Once a week the class met for a lesson in which ideas would be shared, new concepts introduced and assignments given. The curriculum materials were developed on two different levels: an introduction to Logo for grades 4-6 and advanced Logo projects based on playing and modifying a set of "dynaturtle" games. Notable in the project was the use of expert pupils to help others in Logo and the way in which pupils worked together in the classroom.

(4) In 1983 empirical evidence of a strong nature did emerge. Bank Street College's Center for Children and Technology focused research on students' learning of problem-solving techniques and on their social interaction as they work on Logo. "The results raise serious doubts about the claims made for the cognitive benefits of learning to program, particularly in Logo" (Pea in Tetenbaum and Mulkeen 1984:18). Children were asked to read a Logo programme and then explain what would happen as each line was executed (Kurland and Pea in Tetenbaum and Mulkeen 1984:18). The children did not understand sequentiality, conditional statements or recursion, even though they used them. Few children did prior planning before programming and they preferred trial and error methods. Most of them preferred to rewrite the programme completely and then debug it. Glick (in Tetenbaum and Mulkeen 1984:18) states that "the cognitive gains expectable from programming's organizational opportunities and demands do not show up or carry over to planning abilities, nor, to go even further, are the organizational possibilities within programming themselves exploited".

(5) A recent study of Pea (in De Corte 1984:8) took the problem of transfer as its central theme. Two classes of 25 pupils in the age groups 8-9 and 11-12 years respectively were exposed to Logo programming during a whole year. No guided discovery was undertaken, but a discovery learning environment was maintained. In posttests it appeared that the experimental group did not display more skill in planning than a control group with no experience in programming. The question here could well be asked whether transfer would not eventually have occurred had Papert's discovery learning approach not been followed and instruction had been provided more systematically. Certainly research on thinking skills seems to indicate that this could be the desired approach.

(6) In the Department of Psychology at Stanford University, (Milojkovic in De Corte 1984:8) an on-going project is under way. A hundred pupils in Grade 5 (10 years old) were divided into five groups of twenty pupils each. In four of the groups members of the research team taught three periods of 45 minutes a week for 10 weeks. One group was taught Logo, one group learnt BASIC, one group used an educational computer game which could promote programming and

thinking skills; in the fourth group training in thinking skills was provided without the aid of the computer. One group was the control group for which no special educational provision had been made. A series of pretests and posttests were applied. In the project systematic instruction was provided; the discovery learning approach was not followed. The methodological aspects of the study were also carefully considered. It remains a question whether the total instructional time (22,5 hours) is sufficient to reach significant effects. Some suggest that 50 hours are required for significant effects to appear. The results of this study are being awaited.

(7) A study by Howe _et al_. (Kunst 1984:50; Watt 1982:117-118,120), deals with the so-called Edinburgh Logo Project, in which the spirit of the Logo learning environment was not followed and where a structured two-year course in Logo was presented in two years of continuing education. The aim was to use Logo in the exploration of mathematical problems to establish whether ability in Mathematics and talking about the subject could improve. Eleven sixth-grade boys from the George Herriot School were selected from the school's lowest level Maths group. In the first year pupils worked through a set of graded work sheets as an introduction to Logo. In the second year special Logo exercises were done in order to teach topics from the regular Logo curriculum (areas of rectangles, factors and multiples, positive and negative numbers, and plotting co-ordinates on graphs). Care was taken in the experimental design to eliminate methodological problems. Modestly positive effects were found. The experimental group improved a bit more than the control group on a "basic maths" test. The reverse was true on the "maths attainment" test. Teachers responded that pupils who had participated in the Logo course, could better describe their problems and could speak more sensibly on mathematical topics. The teaching approach of the Logo teachers and the individual assistance pupils received could have determined the results rather than the Logo activities as such. The finding, if it can be verified by a more stringent investigation, could indicate that achievement in Maths could increase later.

On the whole the evaluation research in Logo leaves much to be desired (Kunst 1984:49-51):

- In qualitative research the tasks pupils engage in are not described sufficiently.

- In more traditional research designs global achievement measures are used in which the particular insights and skills gained do not emerge very clearly.

- There are also problems with the control group. With what should experimental results be compared - with normal education (where there is always something to be improved) or with efforts of a different nature to realize related aims. When different content is learned, the comparison becomes very difficult.

Although one is justified in being sceptical about some of the more extended claims relating to Logo, it must be remembered that more is known about Logo as programming language for pupils under the age of 15 years than about any other programming language and that via Logo pupils of varied age groups can learn about computers, in a sensible and pleasurable manner (Kunst 1984: 51).

Evaluation studies have recently been carried out as has been demanded from the Logo community to substantiate the claims made about the educational value of Logo (Leron 1985: 32). Most of the findings were negative. Leron does however argue that most evaluation research is to an extent irrelevant and even premature at present:

- The success of Logo as an educational tool will depend on how it is used. In a sense Logo cannot be evaluated - at best a method can be defined for teaching certain parts of Logo and the method can then be evaluated.

- The duration of the studies was too short to produce any significant results.

- The tools used in the evaluation are inappropriate for the processes involved in learning Logo. Instruments used might not be sensitive enough to determine that partial learning has taken place, which is an important foundation in the further development of powerful ideas.

Teachers and researchers report two problems in working with Logo (Martin 1984: 53):

- Knowledge acquisition of a subject area exclusively by means of discovery is time consuming and inefficient. Guided discovery can enhance the pace of learning and help in the retention of insight.

- In most schools the curriculum is very full. Logo must be illustrated as relevant to current curriculum aims if it is to be incorporated in the school programme.

Watt (1982:133-134) draws the following conclusions from the projects he has reviewed:

- Logo can be effective for all pupils in school.

- The training and continual support of teachers are of critical importance.

- Teachers and pupils do require resource materials, guidebooks and project suggestions.

- Pupil interaction has been a positive element of Logo use.

- The potential of Logo has not been exhausted although much work still remains to be done before optimal use and understanding of Logo's learning potential will be realized.

Many of the current instructional activities of Logo are tentative and exploratory (Martin 1984:54).

83

7. PROBLEM AREAS IN LOGO APPLICATIONS

7.1 BACKLASH TO LOGO

In the September 1984 edition of SchoolTechNews a short round-up is provided on a conference of the National Educational Computing Consortium. Mention is made here of the fact that many speakers warned about a backlash to Logo. Billstein (1983:35) also refers to the shortage of research materials, guidebooks, and completed research projects. These shortcomings of necessity affect the training provided to others in the educational application of Logo.

7.2 THE PROBLEM OF PROGRESSING BEYOND TURTLE GRAPHICS

The problem is partly one of using Logo beyond its graphics capabilities (Bull and Tipps 1983-84:54-55). Current implementations of Logo do not invite users to go beyond graphics in such a successful way that users are enticed to make use of graphics (David 1985:14). Suggested projects or programmes in textbooks gravitate towards the graphics capability of Logo. The primitives are those of a particular microworld and not the only possible introduction or sole microworld. In addition, after the initial phase the language becomes much more difficult. This is due to Logo using "lists", the assignment statement with variables and the lack of an indexed looping construct (De Corte 1984:6).

7.3 LOGO AND THE TEACHING OF SUBJECT CONTENTS

Furthermore the potential of Logo as a meaningful way of learning contents has been neglected. "Finding projects and applications which address specific content areas seems to be a prime difficulty in implementing LOGO-based school programs. The problem stems from perceptions of limitations and insufficient illustrations of classroom use rather than the language itself (any memory limitations aside)" (Bull and Tipps 1983-84:54). The Logo community has avoided descriptions of projects of this kind so as not to provide recipes for the "best" way of doing Logo. Problem schemes in various subjects are required for Logo

84

to move beyond computer literacy. It is unlikely that a single teacher will have the resources to create projects sufficient for the whole school year. "The challenge to the LOGO community is to jointly develop and share ideas for projects of this kind" (Bull and Tipps 1983-84:57).

7.4 DISCOVERY LEARNING VERSUS GUIDED DISCOVERY

The notion that teacher selection of specific content invalidates the discovery learning principle is also considered an inhibiting factor in realizing the full potential of Logo in education (Bull and Tipps 1983-84:54-55). Leron (1985:27) contends that there is a tension in the Logo learning environment between maintaining Piagetian learning and the attainment of powerful ideas: "On the one hand, if we adhere to the ideal of totally spontaneous, non-directed, Piagetian learning, we may find children not acquiring the powerful ideas as much as we had hoped. On the other hand, if we push the powerful ideas too brusquely, we are back to classroom type teaching with all the notorious side effects (notably, alienation and a feeling of failure)."

It would appear that the assets of Logo as modern programming language (compare section 4) are not all that easy to learn. This is not to say that these ideas are too difficult for children to learn but that Piagetian learning alone might not be sufficient (Leron 1985:29-30). Although the turtle requires a mathematical language for successful communication to be established, it is not at all inevitable that Mathematics is being learnt by the pupil - again it might be argued that a more structured environment with more tightly structured microworlds followed by verbal or symbolic elevation of the knowledge to a more conceptual level may be required (Leron 1985:30-31). The computer can assist in the activities required for learning, but reflection still poses serious educational problems and has been somewhat neglected in Logo work (Leron 1985:31). Class discussion or verbalisation and reflection between two pupils working on the computer could assist in establishing mastery at a higher conceptual level.

7.5 IMPLEMENTATION PROBLEMS

There are a number of implementation problems (Leron 1983:35; Boddie 1984-85:8):

- Where speed is a consideration the user will find that present versions of Logo are slow in comparison with BASIC (see also Tinker in De Corte 1984:6).

- Current implementations of Logo have little user workspace (see also Tinker in De Corte 1984:6).

- Logo cannot handle all numerical applications.

- Training in Logo is not generally available.

- Although there are excellent textbooks in Logo the choice is limited; finding a suitable text for middle school can be difficult.

- Logo treatment of lists and arrays can lead to tortuous programming for conceptually simple operations.

- Logo's viability as a true general-purpose programming language has yet to be established.

Some of these problems could be overcome with advances in hardware (Billstein 1983:35).

Despite certain drawbacks De Corte (1984:6) comes to the conclusion that Logo is at present most suited to introduce pupils to programming.

7.6 CLASSROOM MANAGEMENT PROBLEMS

When Logo is used more in the discovery learning mode teachers have problems following the pace of certain pupils which in turn creates an administration problem (Pinxteren 1984: 9) in the class. Logo requires a lot in the way of organizational ability from the teacher. Its application can be very labour intensive compared with the application of the electronic teaching machine. It is quite difficult for even an experienced teacher in Logo to cope with a class of pupils if the learning environment as desired by Papert is established (Leron 1985: 28).

7.7 LOGO AND MATHEMATICS

As regards Mathematics, O'Shea mentions the following problems relating to Logo in Mathematics as pupils using Logo have not performed markedly better than others in Maths:

- Much of the metaphorical content of Logo is inappropriate for school Mathematics. "In general current school work is not based on creative problem-solving but rather on the recall of particular algorithms" (O'Shea 1983:248).

- Many of the algorithms taught at school depend on physical lay-out on paper (for example long division).

- In Logo there is heavy emphasis on procedures and processes with the result that it is not so easy writing Logo programmes which can create and manipulate passive structures such as data bases. "So as constituted LOGO makes it easy to express procedural knowledge (mathematical processes) but almost impossible to express declarative knowledge (mathematical facts). The mismatch with some school mathematics, the difficulty of expressing paper and pencil working and the emphasis on procedural knowledge are permanent limitations of LOGO" (O'Shea 1983:248-249).

7.8 "MINDSTORMS" EVALUATED

Rousseau and Smith (1981:53,55) point out some of the aspects lacking in the book and claims Papert makes about Logo:

- Although Papert sees an altered role for teachers and schools in the future he does not elaborate on these points.

- Discovery learning could be counterproductive. "Children in total control of their own learning may choose only narrow areas of interest on which to focus their energies."

- Although Papert was formulating his basic ideas for *Mindstorms* years ago, he did not seem to use very much parallel research as support for his contentions. In this regard the similarity of Papert's ideas and those of Hilda Taba are mentioned as well the similarity between Papert's theories and the synectics model of teaching and learning which is a process-oriented rather than a content-oriented approach. Papert does not mention the work of Goodlad in curriculum analysis. Goodlad found a significant difference in approach between the older curricula which were developed by general educators and administrators and those developed by subject specialists. The latter curricula concentrate on the conceptual structure of a subject and the same approach of the specialist to his subject is required from the pupil. Main concepts of the subject are introduced as soon as pupils are able to manage them. These ideas support those of Papert but he never mentions them. "This points out a significant lack of research-backed support for the ideas presented in the book. Perhaps *Mindstorms* is based on educational research findings, but the reader does not have any way of knowing for sure. This is a major weakness in the book, despite Papert's descriptions of how LOGO seems to work with groups who have attempted and apparently succeeded using LOGO and the turtle." In this regard Steffin (1982:34) says about Papert's assertions that "those related to causal relationships between a computer language and learning are better considered as global, broad, and speculative, rather than be accepted as though they are fact."

7.9 PROBLEM SOLVING AND THE QUESTION OF TRANSFER OF SKILLS

It would appear that the ideas put forward by Papert are not altogether uncontroversial (Kunst 1984:47). It has been claimed that Logo can help develop problem-solving skills, creativity and reflection. If programming could help children to think about thinking, to think through any error and if it promotes mastery of abstract concepts, programming could accelerate cognitive development.

It would seem that one can distinguish between those psychologists and educators who adhere to the notion of skills regarding mental activity and those who are more conceptually oriented, placing the conceptual constructs higher than mere skills.

7.9.1 The skills approach

A number of cognitive psychologists still believe that reasoning powers can be disciplined and can grow continually (White and Collins 1983:234). From the work of Landa and Bloom and Broder, as well as research done by Lochhead (in White and Collins 1983:236) it would appear that an active approach to problem solving, awareness of mental operations, and getting pupils to work together assists them in verbalising and listening to their thought processes. These are the components that differentiate between good and poor problem solvers.

Those who adhere to the skills approach suggest a number of steps that educators can take to improve the teaching of thinking skills, as completion of work sheets and answering high-level cognitive questions are not sufficient in themselves (Beyer 1984:556; De Corte and Verschaffel 1983:451):

- A core of thinking skills should be identified and clearly defined for teaching purposes.

- The components of these thinking skills should be identified as clearly as possible.

- Pupils should have a well-organized body of conceptual knowledge of a content domain.

- Pupils should have at their disposal a number of automatisms and algorithms for tasks that appear frequently.

- They should be armed with a group of heuristic procedures and meta-cognitive skills to approach new, unfamiliar problem situations in a systematic, planned way.

- Direct, systematic teaching should be provided on how these skills should be used in all appropriate content areas and at all appropriate grade levels.

- Developmental curricula can be compiled and implemented - the curricula should integrate the teaching of the thinking skills as well as their combined use.

- Eventually measures of mastery can be formed in the use of thinking skills that are congruent with the skills being taught and which are as valid and reliable as possible.

7.9.2 The conceptual approach

There are reservations regarding the reduction of mental activity to the level of skills. Cognitive scientists have not been able to identify general problem-solving skills - the results of empirical studies on the transfer of knowledge and skills to new tasks have not yet revealed a clear pattern and little is known about these mechanisms (Kunst 1984:48). Research has shown no significant transfer of success from one training task to success in another (Newell in Tetenbaum and Mulkeen 1984:17). In general, theory and research in cognitive science suggest that there is not a single homogeneous set of skills that can be identified as the most important skills of problem solving - different kinds of problems seem to require different kinds of skills (Greeno in Tetenbaum and Mulkeen 1984:17).

"Mental activity or process ... is usually conceived of in terms of some consciously initiated act or acts on the part of the subject and these are in turn seen as skills deemed necessary for the formation of concepts in the disciplines or the domains involved" (Smith 1984:226). A skill can only be assessed in the outcome or product of an application of the skill. Even then one still could not assume a set of mental events or temporal activities which could be called a skill (Smith 1984:227). The conceptualisation of mental activity in terms of skills does not accommodate things such as imagination, creativity, intuition, originality and understanding (Smith 1984:227-228). A skill can be exercised at will. However, it is not possible to decide consciously to understand. "There are then substantial and most important areas of learning which cannot even be expressed as acts, let alone skills, and in which activity is not directly originated by the self and is largely a matter of illumination" (Smith 1984:228). The idea of a skill in the context of the mind can be very limiting and inadequate in teaching - it cannot be assumed that there are "easily identifiable skill sequences for the mind" (Smith 1984:229). If mental activity cannot just be seen as acts initiated by the individual it would make sense to allocate exposition and explanation a central position in the teaching process. Mental skills or acts do not of themselves lead directly to the formation of new concepts or new understanding as some of the curriculum literature would suggest (Smith 1984:230). About the transferability of skills Smith (1984:230-232) makes the point that many of the high-level mental skills become specific in terms of the domain or the material under consideration; a domain requires different mental activities or psychological acts. Steffin (1982:34) would support these reservations as the bringing together of a medium, and software only has the potential of becoming powerful instructional media. "Successful instruction requires the crafting of an environment, by an instructor, in which learning will occur" (Steffin 1982:34).

No cognitive learning theory in which the underlying relationships between the mechanisms has been more precisely worked out is available (Kunst 1984:48). Division of a problem into part-problems is a general and recommended problem-solving strategy and does not only apply to programming (Kunst 1984:48).

The central question is really whether concepts and methods of thought can be gained via programming that are applicable in other subject areas (De Corte 1984:7). In this regard De Corte (1984:7) says that there are reasons for not accepting this statement at face value, but demanding empirical proof. The history of learning psychology indicates that transfer is not easily achieved and that it should probably be aimed at very explicitly. Recent research in cognitive psychology has indicated that skill in problem solving in one content domain is very much dependent on domain-specific knowledge.

De Corte (1984:7) states that there is very little scientific proof that could lend support to the optimistic hypotheses of Papert. What must however be added is the realisation that very little thorough investigation has been done and that there is no empirical base on which the hypothesis can be negated (De Corte 1984:8).

Similarities between the processes of Logo and problem solving would have to be pointed out, made explicit and practiced. "However, one has to wonder whether teaching problem solving through teaching programming is the most efficient way to go about it" (Tetenbaum and Mulkeen 1984:19). Educators are convinced of the necessity of a skill such as problem solving but are not always properly informed of the present state of the art to understand the limitations (Tetenbaum and Mulkeen 1984:18). "Thus, the promises implied by the proponents of LOGO have produced unrealistic expectations regarding the ability of computer programming - even in a perfect environment - to produce a generalised problem-solving ability" (Tetenbaum and Mulkeen 1984:18). Few schools awaited empirical research before implementing Logo and indeed little evidence was to be found (Tetenbaum and Mulkeen 1984:18).

As it does not seem at present as if Logo can develop general problem-solving ability, the only reason at present for teaching Logo is that pupils acquire a programming language. "Here, too, time is needed for reflection and evaluation, since there is serious debate in the educational community regarding the role of programming in technological literacy and since programming itself is undergoing significant change, it is conceivable that future programming will take the form of highly specialized, domain-specific languages rather than the general-purpose languages prevalent today" (Sheingold et al. in Tetenbaum and Mulkeen 1983:19).

8. A NUMBER OF RESEARCH QUESTIONS RELATING TO THE LOGO LEARNING ENVIRONMENT

It has been pointed out that the claims relating to Logo are not as yet supported by research results of integrity, but in this regard improvement is possible (Kunst 1984:43).

8.1 THE COGNITIVE EFFECTS AND DEMANDS OF PROGRAMMING

Collis (1983:44) takes the approach of Salomon to media research and applies it to the use of the microcomputer in education. A number of problems need to be addressed:

- It has to be determined whether the cognitive demands of programming a computer are in any way unique.
- It is not at all apparent which categories of cognitive behaviour are affected by the use of the computer in instruction, be it memory, the acquisition of skills or pattern perception.
- The "unique patterns of influence" that are present in programming need to be established. This includes aspects such as sequential thinking, the observation of causal relationships, and the cognitive significance of coding versus the cognitive significance of divergent thinking about the structure of a programme.

8.2 UNDERSTANDING RECURSION

It is not always apparent whether beginners make use of the conceptual models of the advanced constructs even when applied successfully (Soloway et al. in Kunst 1984:49). Kahney (in Kunst 1984:49) at the Open University found that students had no consistent mental model of recursion after a course on recursion in Solo (an artificial intelligence language much like Logo). Claims that pupils understand recursion require more evidence than the procedure definition provided (Kunst 1984:49).

8.3 SALOMON AND RESEARCH ON COMPUTERS IN EDUCATION

Salomon (1984:7-11) mentions classes of educational research questions regarding computers in education. All are equally applicable to Logo. They are:

- Research concerning the long-range, cumulative effects of computer use which Salomon regards as the most urgent question to be answered. Particularly relevant here is Papert's assertion that pupils using Logo can develop an awareness of different styles of thinking, that is, exposure to the computer can become a metacognitive experience (Papert 1980:27). As the computer penetrates further in society the research into long-range effects could become increasingly difficult when, as in the case of research into television, comparable control groups become more difficult to find (Salomon 1984:8). This can inhibit the quality of research findings considerably.

- Research should also pay attention to the user's influence on the way he experiences technology, in this case the computer and Logo. People are not passive users of technology: "By their choice of effort expenditure or mindfulness in processing, by their choice of task and purpose, and by their choice of what elements to attend to, they affect the way technology can affect them" (Salomon 1984:9). With regard to Logo, Salomon (1984:9) mentions that there is a great difference between debugging a programme by trial and error and thinking the problem out. "There is a growing body of research to show that the average young Logo user does not often engage in the latter" (Pea and Kurland in Salomon 1984:9).

- Research of an analytical nature regarding unique computer capabilities. In this regard Salomon (1984:9) states : "An important lesson we have learned from television research in education is that no medium and technology, in and of themselves, have much of an impact on learning or cognition. It is always something specific in them which may afford activities, experiences, or aroused cognitions hitherto unaffected." Here the researcher is not looking at the typical effects of computer use but at what computers can be made to do.

- A further research priority concerns the whole question of the transfer of learning from the computer to non-computer contexts. The question of transfer from the Logo learning environment to other tasks is to be taken for granted as yet. "In afwachting van meer onderzoek kan veilig worden gesegd dat de eventuele transfer-effecten van LOGO vooral sullen optreden wanneer voor de leerling expliciete verbanden worden gelegd met situaties buiten de LOGO-microwereld" (Kunst 1984:49). The question is pertinent as the justification for use of computers in education often includes reference to transfer of skills and knowledge to non-computer environments and tasks. Research findings tend to indicate that there is very little transfer between situations within a domain, and even less between domains. Transfer can take place in two ways: There is mindful, active generalisation of what has been learned and there is automatic transfer of something that has been over-learned and practiced in various situations (Salomon and Perkins in Salomon 1984:10). In the Logo learning environment the question is how much practice must be provided or how aware must pupils be in order that transfer take place.

In conclusion: "The kind of research very much needed at present is detailed studies and documentation of various issues related to children's learning, and insightful, responsible reporting of findings from these studies" (Leron 1985:32).

9. LOGO AND RESEARCH METHODOLOGY

In the study of computer use in education the researcher faces new methodological challenges (Salomon 1984:8) which can be faced today owing to advances in research methodology.

Mention was already made in Paragraph 3 of the question of deciding between maintaining a discovery learning approach or opting for guided discovery with teacher intervention. This question also affects the research methodology chosen in research on Logo. If the experimental research paradigm is chosen, the question of measurement becomes very pertinent. In this approach the measurement would often take the form of a pretest and a posttest administered at the beginning of the period of exposure to Logo and at the end thereof to determine whether there were any benefits for the pupils in being exposed to Logo. If the Logo learning environment is to be maintained, measurement would be against the spirit of it. This would place a question mark over the suitability of the experimental research paradigm in Logo learning situations. At the same time Salomon (1984:8) points out that controlled laboratory experiments are unlikely to reveal the long-range effects of for example the use of Logo. Streibel (1983:483) states that the success of problem-solving strategies is only visible after a long demanding process so that teachers/researchers cannot rely as much on objective achievement tests. "These (laboratory experiments) can suggest the possible, not the actual" (Salomon 1984:8). These effects are not easy to determine and can be confounded with short-range effects. However, guided exploration of Logo could well be reconciled with the experimental research paradigm. It could also be feasible to maintain the spirit of the Logo learning environment and apply the qualitative approach to research by using structured or unstructured observation or by using action research (Hattingh 1983:11-15) in this situation.

For research purposes measurement must be congruent with the content of the tasks performed during instruction or the experimental period. If the relationship of Logo to cognitive development is going to be investigated, the nature of skill testing must be taken into account. The researcher, teacher and developer of the instructional/test material must agree on the description of the skills to be taught and tested and the reporting of the results must reflect the understanding of the nature of the thinking skills that were measured. In an experimental research design where measurement in quantitative terms is inherent to the research paradigm, the nature of test items is particularly relevant to the validity of the research findings. Beyer (1984:560) states that "... if the test items are to have any validity at all, they must present content or data about which students have not yet formed generalizations or knowledge claims. Ideally, test items should confront students with unfamiliar data about which they have no preconceived notions and to which they must apply specific skills to arrive at correct answers."

As regards improvement in the evaluative results on Logo, Kunst (1984:50) recommends:

- Formal analysis of standardized tests will yield information on insights and skills gained.
- Results of procedures should be spelled out by the experimental group in advance.
- Memory experiments will also provide better indications of the skills which have come into play.

For research on problem solving and metacognitive skills, De Corte and Verschaffel (1983:452-456) recommend a number of techniques. These techniques reflect the movement away from externally observable learning results to the underlying cognitive processes and structures of the subjects producing the results. The techniques are also an extension of having pupils complete tests in which the activity of the researcher is in the main restricted to the presentation of a series of predetermined tasks and the registration of the answers of the pupil. These techniques are:

- Clinical interviews. This is very flexible and concentrates on the individual. The researcher formulates a number of hypotheses, presents the child with process-related questions as well as diagnostic subtasks on critical aspects of the main task. The cycle of hypothesis formulation, testing and adaptation continues until the researcher has a grasp of the underlying cognitive processes and structures of the child.

* Individual interviews. This is a technique which has recently gained in popularity with regard to research on problem solving. The technique differs from the clinical interview as the interviewing and processing of the results afterwards is done in a more systematic manner. The structured approach which is characteristic of the standardized test is therefore combined with the flexibility of the clinical interview. The techniques involved here include the following:

** Explaining aloud - as the task is done - hypotheses, considerations, part solutions and steps in the thought process;

** explaining and justifying the route to the solution chosen also in retrospection;

** providing a suitable formula for the solution;

** using the form of play to represent the task with the aid of dolls and blocks.

To enhance the reliability and completeness of results, the following techniques are used in the individual interview:

** Questioning by the researcher.

** Mutual observation: the researcher states his hypotheses on the route to the solution the child followed and the pupil is allowed to correct or fill in the detail.

** Observation of the actual conduct of the pupil during the solution of the problem (mouth movements, manipulation of fingers on the blocks, etc.). The time to reach the solution can be measured as well.

** Task variation. By varying an aspect of the task hypotheses of the researcher can be altered or find further support.

** The researcher provides help. Van den Berg et al. (in De Corte and Verschaffel 1983:455) distinguish the following forms of help:

(1) Questions to help the pupil on his way.

(2) Presentation of material (blocks, dolls) and the suggestion that the solution first be sought using the materials.

(3) Reformulation of the task to bring out the semantic relations more explicitly and less ambiguously.

Against the background of the above it can be said that in Logo research, the following research decisions should be taken by distinguishing between design-related and Logo-related decisions:

Logo-related decisions:

- Determine what aspect of Logo use in school (computer literacy, introduction to programming, cognitive development or subject related applications) will form the focus of the research.

- Decide on the type of learning environment that would be suitable for the experiment, i.e. discovery learning (heuristic approach) or a structured learning environment (partly ostensive approach). Obviously a whole continuum of possibilities exist here.

- Create the microworlds that would be suited to the focus of the research and the learning environment envisaged.

- If cognitive research is to be the focal point a decision regarding the product/skills approach versus the process/conceptual approach must be taken.

- If instruments and materials are to be developed especially for the research project, a development team with the following members present should be formed:

- Subject specialist
- Programmer
- Media specialist
- Educational psychologist
- Specialist in instructional design

Design-related decisions:

- Choose the research paradigm, either quantitative, qualitative, or action research for the experiment and follow the discipline imposed by the research paradigm as closely as possible.

- If an experimental research paradigm is to be chosen, select a research design (compare Campbell and Stanley 1966), identify the appropriate statistical techniques involved for processing and interpreting the data. Identify possible problematical variables which could impair the interpretability of results and make the results susceptible for rival hypotheses, and control for these variables in the experimental situation.

- If a qualitative research paradigm is to be chosen, develop the instruments for example for structured or unstructured observation or interviews. Create mechanisms for immediate feedback in the research situation to enable implementation of results as the experiment progresses (relevant to action research).

- Establish which standardised research instruments are available from universities, research institutions or professional organizations and determine what instruments will have to be developed by the project team for the research (especially in the event of research pertaining to metacognition and/or computer literacy). Determine whether the instruments for measurement are congruent with the experimental tasks pupils are to be exposed to (validity and reliability).

- Determine who the target group will be.

The decisions mentioned here are by no means comprehensive and no strict order is suggested, but an attempt was made to focus on a number of the most important issues.

10. CONCLUSION

Certainly Logo is growing in popularity in schools. Although research still has much to reveal about Logo use, teachers will continue to experiment with Logo in class and implementation will continue apace. Provided one has a balanced view of Logo, its strong points and problem areas, sensible and constructive applications will prosper and rightly so.

REFERENCES

ABELSON, H. A beginner's guide to Logo. Byte 7(8), August 1982:88-112.

BEYER, B.K. Improving thinking skills - practical approaches. Phi Delta Kappan 65(8), April 1984:556-560.

BILLSTEIN, R. Learning Logo and liking it. The Computing Teacher 10(3), November 1982:18-20.

BILLSTEIN, R. Turtle fever. The Computing Teacher 11(2), September 1983:34-36.

BITTER, G.G. The road to computer literacy: a scope and sequence model. Electronic Learning 2(1), September 1982:60-63.

BODDIE, J.B. A tour of Babel. The Computing Teacher 12(4), December/January 1984-85:8-10.

BRACEY, G.W. Computers in education: what the research shows. Electronic Learning 2(3), November/December 1982:51-54.

BULL, G., TIPPS, S. Problem spaces in a project-orientated Logo environment. The Computing Teacher 11(5), December/January 1983-84:54-57.

CAMPBELL, D.T., STANLEY, J.C. Experimental and quasi-experimental designs for research. Boston : Houghton Mifflin, 1966.

CARTER, R. Logo and the great debate. Microcomputing V(9), September 1981:48-51.

CARTER, R. The complete guide to Logo. Classroom Computer News 3(5), April 1983:35,37-39.

CLEMENTS, D.H. Logo programming: can it change how children think? Electronic Learning 4(4), January 1985:28-75.

COLLIS, B. Questions for research on microcomputers as instructional media. Educational Technology 23(3), March 1983:43-44.

DAVID, A. Four instructor roles in an extended Logo environment. AEDS 23(7,8), January/February 1985:13-15.

DE CORTE, E. Computers en onderwijsleerprocessen. Fasette 3(2), 1984:5-9.

DE CORTE, E., VERSCHAFFEL, L. Analyse en beïnvloeding van het probleemoplossend denken. Tijdschrift voor Orthopedagogiek 9, September 1983:449-463.

ENGELBRECHT, S.W.H. Die onderwyser en die stroomversnelling van die tegnologie. NOU-Blad 14(2), November 1983:15-18.

GOLDBERG, M. Two Logos for the IBM PC. Byte 9(9), Fall 1984:91-124.

HARTLEY, J.R. Some psychological aspects of computer-assisted learning and teaching. PLET 22(2), May 1985:140-148.

HARVEY, B. Why Logo? Byte 7(8), August 1982:163-193.

HARVEY, W. Which programming language is right for you? Classroom Computer Learning 4(9), April/May 1984:51-53.

HATTINGH, D.L. Die aksienavorsingsparadigma as alternatief vir navorsing oor rekenaarondersteunde onderwys. Pedagogiekjoernaal 4(2), 1983:11-32.

HATTINGH, D.L. Enkele modelle vir rekenaarondersteunde onderrig. Suid-Afrikaanse Tydskrif vir Opvoedkunde 4(3), Augustus 1984:110-115.

KEARSLEY, G., HUNTER, B., SEIDEL, R.J. Two decades of computer based instruction projects: what have we learned? T.H.E. Journal 10(3), January 1983:90-94.

KUNST, H. Logo: achtergronden, evidentie en mogelijkheden. Pedagogische Studien (61), 1984:43-54.

LASKI, J. Logo look-alikes. Times Educational Supplement 3508, September 23, 1983:30.

LAWLER, R.W. Designing computer-based microworlds. Byte 7(8), August 1982:138-160.

LAWTON, J., GERSCHNER, V.T.A. A review of the literature on attitudes towards computers and computerised instruction. Journal of Research and Development 16(1), 1982:50-55.

LERON, U. Logo today: vision and reality. The Computing Teacher 12(5), February 1985:26-32.

LOUGH, T. Where is Logo? The Computing Teacher 11(5), December/January 1983-84:30-32.

MARTIN, A. Logo - more than turtle graphics. Computers in Schools 6(2), January 1984:50-54.

MENCONI, D., RICHARDS, T. Logo vs Basic - which language is better? Microcomputer Owner, May 1984:17-20.

MOJET, J.W. Toepassingsmogelijkheden van computers in het speciaal onderwijs. Pedagogisch Tijdschrift, Jaargang 9, Februarie 1984:94-104.

O'SHEA, T. A critique of Logo as a learning environment for mathematics. In: LEE, V., ZELDIN, D. Planning in the curriculum. Suffolk : Hodder and Stoughton, 1983.

PAPERT. S. Mindstorms: children, computers, and powerful ideas. Sussex : Harvester, 1980.

PINXTEREN, H. Computertaal voor kinderen in het basisonderwijs. Computer in het Onderwijs 4, Augustus 1984:8-9.

PRENTICE, L.R. Educational computing - the giant awakes. Microcomputing V(9), September 1981:86-91.

REIMER, G. The effects of a Logo computer programming experience on readiness for first grade, creativity, and self-concept. "A pilot study in kindergarten". AEDS 23(7,8), January, February 1985:8-12.

RIORDON, T. Creating a Logo environment. The Computing Teacher 10(3), November 1982:46-50.

ROTH, R. A comparison of Logos: today's turtle is no slowpoke. Creative Computing 10(12), December 1984:94-106.

ROUSSEAU, J.F., SMITH, S.M. Whither goes the turtle? Microcomputing V(9), September 1981:52-55.

SALOMON, G. Computers in education: setting a research agenda. Educational Technology 24(10), October 1984:7-11.

SMITH, M.J.E. Mental skills: some critical reflections. Journal of Curriculum Studies 16(3), 1984:225-232.

S.N. Expert tells how schools integrate micros. SCHOOLTECHNEWS 2(1), September 1984:5.

STEFFIN, S.A. A challenge to Seymour Papert. Educational Computer Magazine 2(4), July-August 1982:34-36.

STREIBEL, M.J. The educational utility of Logo. School Science and Mathematics 83(6), October 1983:474-484.

TETENBAUM, T.J., MULKEEN, T.A. Logo and the teaching of problem solving: a call for a moratorium. Educational Technology 24(11), November 1984:16-19.

TORGERSON, S. Classroom management for Logo. The Computing Teacher 11(5), December/January 1983-84:12-14.

WATT, D. Logo in the schools. Byte 7(8), August 1982:116-134.

WILLIAMS, G. Logo for the Apple II, the TI-99/4A, and the TRS-80 color computer. Byte 7(8), August 1982:230-290.

WEIR, S. Logo and the exceptional child. Microcomputing 5(9), September 1981:76-83.

WHITE, K.B., COLLINS, R.W. An experimental investigation utilizing the computer as a tool for stimulating reasoning skills. Association for Educational Data Systems 16(4), Summer 1983:234-243.

ZACHMEIER, W.J. K-8 computer literacy curriculum (revised 1982). The Computing Teacher 10(7), March 1983:7-10.

THE USE OF A DATA BASE MANAGEMENT SYSTEM AS AN EXPLORATORY LEARNING OPPORTUNITY WITH A MICROCOMPUTER

J.G. KNOETZE

1. INTRODUCTION

Parallel to the development initiated by the industrial revolution, knowledge expanded at a phenomenal rate in all fields. To keep pace, education through the ages underwent several changes in emphasis. Curricula were adapted and expanded, the number of school subjects were increased and totality education made way for subject education. Educational planners realized that the adaptation of school curricula could not keep pace with the rate at which knowledge was expanding. The idea of "teaching people how to learn" (Hebenstreit 1980: 4) became the slogan of the time.

With knowledge expanding at an astounding rate, pupils should be equipped to help themselves in the academic and other intellectual fields. This goal may be attained through the integration of educational media into exploratory learning. The subject teacher may utilize technologically sophisticated media such as the microcomputer to create exploratory learning opportunities which will enable pupils through self-activity, to exploit their abilities.

2. EXPLORATORY LEARNING OPPORTUNITIES

On the basis of the situation analysis and reflection on envisaged learning results the teacher plans or anticipates the course of events that should be set in motion in the classroom situation to realize actual learning results (Krüger 1980: 81). Teaching and learning conditions in the classroom are monitored and manipulated continually to establish a favourable environment or atmosphere within which learning is actualized in accordance with the pupil's personal ability. The favourable learning environment enhances the realization of the learning process and involves pupils' learning and mastering of general and subject-specific knowledge and skills. This may be labelled as a real learning opportunity. Such real learning opportunities are established in partnership by all the participants involved. The teacher and pupils are partners who create learning opportunities through interpersonal communication. The teacher's interpretation of the classroom situation reflects his didactic ability to create a dynamic course of learning. Rigid adherence to a planned teaching design could lead to learning resistance in the learner. The learner's initiative to explore lesson content by himself may be inhibited by learning resistance. Consequently the learner is deprived of opportunities for exploration and is hampered in his attempt to build a stock of exploratory knowledge and skills. In the light of the increasing volume of knowledge, it is essential that pupils should be able to explore subject contents in a more analytical, comparative and interpreting manner. Therefore the teacher may not permit any opportunities for exploration to fail. Freedom and mobility in the course of instruction should be permitted to counteract learning resistance. Flexibility in the course of teaching and learning events is essential to the development of each pupil's unique style of thought.

Opportunities in which the learner can explore subject content and exploit his abilities are phases in development that should culminate in the mastering and self-appropriation of cognitive strategies, knowledge and skills. A feature of these phases is the confidence that each learner has the ability to summarize, criticize, analyse, synthesize and evaluate (Krüger 1980: 130). The sincerity of this confidence is reflected in the opportunities created for the learner to act independently. Learners who have undergone these development phases should be able to face academic and other challenges with increasing independence and confidence.

3. EXPLORATORY KNOWLEDGE AND SKILLS

To explore means to conduct an investigation or to undertake a voyage of discovery. In school the fields of investigation are demarcated in the form of syllabus themes in subject syllabuses and defined according to scope. Traditionally the task of the subject teacher in this regard is to unveil these fields and the teacher's information-providing function is often overemphasized. Owing to this one-sided view teachers often tend to interpret the pupils' need for assistance only in terms of the teaching of subject-related information. The skills required to gain access to the basic facts in a field or subject are often neglected. A lack of the initiative and self-confidence required to explore and master new dimensions in adult life independently is one of the most significant consequences of this attenuated learning experience. To ensure that initiative, self-confidence and independence are promoted it is essential for learning opportunities to be structured accordingly. This objective can be realized only if the essential knowledge and skills can be identified by the teacher.

A description of the information retrieval procedures and skills in operational terms facilitates the performance of the identification task. Table 1 contains a few proficiency verbs that are often used in this regard. There are divergent descriptions and views with regard to the meanings of these verbs. The differences can mainly be ascribed to the fact that these verbs have subject-specific meanings. In a general and neutral (subject-independent) description of the proficiency verbs the fine nuances cannot be be accommodated and the scope of this article does not lend itself to the distilling of a general and neutral description of the nuances either. Every teacher who is also a subject expert will recognize the relevant verbs in Table 1 and attach a specific meaning to them.

The divergent meanings that are evoked by the proficiency verbs and the nuances that may exist in respect of the underlying knowledge and skills do not constitute a reason for omitting the development of these skills from mainstream education. The traditionally uniform approach to the realisation of teaching and learning opportunities in which pupils are often forced to conform by the teacher's explicative behaviour can seriously handicap the development of information retrieval knowledge and skills. If the differences in cognitive development levels and mental abilities of pupils are taken into account, a differentiated approach that makes independent structuring possible is beneficial to the development of knowledge and skills. A differentiated teaching practice that makes provision for cognitive development and corresponds to the inherent abilities and needs of learners is made possible by, among other things, individualized teaching. The implementation of traditional and almost stereotype teaching methods that give the teacher a feeling of situation control and security often suppress the creation of an individualized learning environment in a group teaching situation. According to Gallini (1983: 8) the teaching management functions of the teacher are ineffective in a group situation, so that individualized teaching is realized inadequately. Teachers can use the computer as a technological vehicle (Gallini 1983: 8) in such a creative manner that pupils in heterogeneous group situations can be guided orderly and systematically to master subject skills and to develop unique intellectual abilities.

TABLE 1 PROFICIENCY VERBS

PROFICIENCY VERBS

Analyse
Categorize
Classify
Collect
Compare
Conclude
Construct
Deduct
Design
Distinguish
Evaluate
Extrapolate
Generalize
Generate
Identify
Identify relations
Interpolate
Inventorize
Order
Organize
Reduce
Restructure
Schematize
Select
Structure
Synthesize
Systematize

A few of these proficiency verbs are defined by the authors below:

Basson _et al_. (1983: 17-19)
Calitz (1981: 50-57)
Du Toit (1981: 31-34)

4. THE COMPUTER AS EDUCATIONAL MEDIUM

The possibilities of using the computer as an educational medium are classified by De Corte (1984: 6) on the basis of the degree of initiative and learning activities of pupils involved in a learning opportunity. The possibilities of applications are grouped into three clearly distinguishable classes, namely computer as teacher, computer as tool and programming of the machine (translated from De Corte 1984: 6). Table 2 contains the essential aspects of these application possibilities.

The computer as a tool can be implemented in creative ways in subject teaching in all subject fields with the minimum equipment. If no subject-oriented teaching software is available, or if only limited computer facilities (hardware) are available owing to financial and other factors, this method is very suitable.

TABLE 2 ESSENTIAL ASPECTS OF APPLICATION POSSIBILITIES

APPLICATION POSSIBILITY	ESSENTIAL ASPECTS
Computer as teacher	The course of learning is controlled by means of a programme. Computer-assisted instruction is usually given as example of this application possibility.
Computer as tool	Computers are available to users and make a greater degree of initiative in respect of application possible. The use of commercially available programme packages such as word-processing packages, data base management systems and graphical packages are included here.
Programming the computer	The initiative here lies with the user who devises possible uses and applications. The development of skills in problem solving are often included here.

The computer as a data base management system has the potential of being a teaching and learning aid that can make individualized teaching possible. The teaching potential of this application is discussed below.

5. DATA BASE MANAGEMENT SYSTEM: A DESCRIPTION

A data base management system (DBMS) is a software system that enables the user of a microcomputer, minicomputer or mainframe computer to store data (information) on and later retrieve this data from a magnetic medium in an orderly and systematic manner. Although the concept data base is more often linked to computer terminology, data bases are well known in a concrete and tangible form. A card catalogue in a library is a data base that has been developed from an orderly collection of information recorded on index cards.

According to Ely (1983: 117) a DBMS has three primary functions, namely:

- Indexing of information. Information (or data) is fed in and stored on the basis of a custom-designed format (template).

- Retrieval of information. After a data base has been established information can be retrieved by means of a search key (key word).

- Selective retrieval of information. Selective retrieval of information is done on the basis of a search profile comprising one or more search keys that are specified by the user.

Data base management systems are user oriented and are characterized by options that enable the user to

- design and change a format for keying in data;
- specify a search profile for retrieving verbal and/or numerical data;
- keep data up to date on a continuous basis;
- organize and sort data in alphabetical and increasing or decreasing numerical order, or
- specify a format for printed data.

Data base software packages are designed and developed specifically for target groups in management and commerce. These programme packages can successfully be implemented fully in education.

6. DATA BASE MANAGEMENT SYSTEMS AS EDUCATIONAL TOOLS

A DBMS can be integrated into teaching and learning events in original ways with a view to harmonizing teaching and guidance with pupils' individual styles of learning and thinking. In this way the guidance task and actions of pupils are optimalized. The value of this use of the computer as a tool is explained by means of a single example.

In the subject Physical Science the physical characteristics of the chemical elements are included in the subject themes from Standard 6 to Standard 10. Among other things quantified physical characteristics such as density, melting point and boiling point are used to explain regularities in nature. This theme provides the teacher with opportunities for using a data base management system meaningfully. Figure 1 contains an example of a record (index card) of a data base on the physical characteristics of elements.

FIGURE 1: EXAMPLE OF A SINGLE RECORD

PHYSICAL CHARACTERISTICS OF ELEMENTS

NAME OF ELEMENT: COPPER
SYMBOL OF ELEMENT: Cu

DENSITY (g/ml): 8,96
BOILING POINT (degrees Celsius): 2595
MELTING POINT (degrees Celsius): 1083
SPECIFIC HEAT CAPACITY (J/kg °C): 380
CONDUCTING OF ELECTRICITY: Good

One of the ways in which the data base on the physical characteristics of elements can be implemented in teaching situations is discussed briefly below.

7. POSSIBLE MODES OF IMPLEMENTATION

When discussing different modes of implementation it is assumed that the pupils concerned have already mastered the basic indexing techniques and selective retrieval procedures in order to use a DBMS meaningfully. The availability of microcomputers for use by groups of 2 to 4 pupils is accepted as general practice. However, successful implementation with one microcomputer per class and effective organisational management by the teacher is not excluded.

To integrate a DBMS as a tool in training and teaching situations it is essential to determine in which way(s) the pupils can use it as a learning tool. The use of selective retrieval techniques and procedures to answer questions and solve problems is an implementation method that can always be kept in mind when planning learning opportunities. Initially, structured assignments in the form of questions and problems aimed at developing specific skills and abilities are methods that promotes pupil involvement and activity and enable the teacher to support and guide pupils in an individualized way. The use of assignment cards gives direction to the learning activities and makes tempo differentiation possible. An example of an assignment card that concerns the data base on the physical characteristics of the chemical elements is given in Figure 2.

FIGURE 2: EXAMPLE OF AN ASSIGNMENT CARD

ASSIGNMENT CARD: PHYSICAL CHARACTERISTICS OF ELEMENTS

DATA FILE: PHYSICAL CHARACTERISTICS

ASSIGNMENT: Use the information in the data file to answer the questions below.

---

1. Indicate the boiling point of
   (a) potassium
   (b) mercury
   (c) iron

2. Indicate the melting point of
   (a) aluminium
   (b) copper
   (c) gold

3. Indicate the density of
   (a) mercury
   (b) aluminium
   (c) chrome

4. Which element has the highest boiling point?

5. Which element has the highest melting point?

6. Which element has the highest density?

7. Which element has the lowest boiling point?

8. Which element has the lowest melting point?

9. Which element has the lowest density?

10. Which elements are solids at a room temperature of 25°C?

11. Which elements are liquids at a room temperature of 25°C?

12. Which elements are gases at a room temperature of 25°C?

13. Which elements that are solids at 30°C will float on water with a temperature of 30°C?

14. Which elements that are solids at 20°C will not float on mercury with a temperature of 20°C?

15. What is the volume (in litres) of 400 g of gold?

In all subject fields there are certain themes of which the content is exclusively factual knowledge that has to be learnt. With a few exceptions verbal communication of these facts by the teacher is the general teaching method. An alternative method that will promote pupil activity can be implemented by integrating an extensive and comprehensive data base as a source of information to provide answers to questions that test knowledge. The validity of this method of implementation can be questioned by the sceptical user by asking whether the use of a textbook, which is surely also a source of information, will not have the same effect. However, a textbook, and a school textbook in particular, has a specific structure and form of content presentation that can restrict the development of the skills required to gain access to fields of knowledge. The pupil is deprived of the opportunity for reduction, interpretation and systematization. The skills concerning the gaining of access to information largely determine the attitude towards studying and investigative activities of the learner in the teaching situation. In addition the relevance of political and demographic information in particular in textbooks decreases rapidly. By using a DBMS the teacher can adjust the content to ensure that the most recent information is available to the pupils. This documentation task can also be incorporated as a deliberate learning opportunity in which the pupil is responsible for maintaining the data base.

Project work is a further facet of teaching and training opportunities in which the DBMS can be used successfully. Pupils are responsible for building a data base on a specific research theme on their own. The DBMS is used here to inventorize information on the basis of categories determined by the pupil or group of pupils. New and unusual relations between apparently independent elements can be discovered by the pupils with the aid of selective retrieval techniques. This method of implementation has definite positive implications for the development of creativity.

The following view by De Corte (1984: 7) will suffice to conclude this brief exposition of methods of implementation: Using the computer as a tool is definitely one application possibility that deserves more attention in future.

8. CONCLUSION

Not all subject themes offer the possibility for using the computer as aid in a creative manner. However, suitable themes for such implementation should be identified to create the opportunities for developing higher cognitive thinking skills. Subject-didactic training courses of teachers should make provision for the identification of suitable subject themes and the development of the relevant teaching skills.

REFERENCES

BASSON, N.J.S. et al. Lesontwerp. Kaapstad: Juta, 1983.

BEISHUIZEN, J.J. Informatie verzamelen in een bibliotheek: coaching van zoekstrategieën. In: VAN HEES, E.J., DIRKZWAGER, A. Onderwijs en de nieuwe media. Lisse: Swets & Zeitlinger, 1982.

BRINK, B. DU P., JONES, R.C. Physical science 10. Cape Town: Juta, 1979.

CALITZ, L.P. Vraagstelling as onderwysvaardigheid. Potchefstroom: Pro Rege, 1981.

CAWOOD, F.B., MULLER, I., SWARTZ, J.F.A. Grondbeginsels van die didaktiek. Bloemfontein: Nasou, 1982.

DE CORTE, E. Computers en onderwijsleerprocessen. Facetten 3(2), 1984.

DODDS, R. Rekenaarwoordeboek. Kaapstad : HAUM, 1984.

DU TOIT, C.M. Die belangrikheid van 'n mediateek (selfstudiesentrum) in universiteitsonderrig. Bulletin vir dosente 14(2), Okt. 1981: 28-38.

ELY, D. Computers and the handling of information. In: MEGARRY, J. (ed.) World yearbook of education 1982/83. Computers in education. New York : Nichols Publishing Company, 1983.

GALLINI, J.K. What computer-assisted instruction can offer toward the encouragement of creative thinking. Educational technology 23(10), Oct. 1983: 7-11.

HEBENSTREIT, J. Micro-computers in secondary education. In: TAGG, E.D. Microcomputers in secondary education. Amsterdam: North-Holland, 1980.

HUNTER, B. Problem solving with data bases. The computing teacher 12(8), May 1985: 20-27.

KNOETZE, J.G. Omskrywing van enkele terme in die onderrigwetenskap. UP-dosent 4(2), Jul. 1983: 24-32.

KNOETZE, J.G. Die funksionaliseringsalgoritme in die onderwys van enkele temas in die natuur- en skeikunde. Pretoria: Universiteit van Pretoria, 1983. (Ongepubliseerde M.Ed.-verhandeling)

KNOETZE, J.G. Rekenaargeletterdheid vir studente. UP-dosent 6(2), Jul. 1985.

Kr GER, R.A. Beginsels en kriteria vir kurrikulumontwerp. Pretoria: HAUM, 1980.

MARAIS, D., CALITZ, L.P., VAN WYK, C.F.M. Die integrering van onderwysmedia in lesaanbieding. Johannesburg: McGraw-Hill, 1983.

ODENDAL, F.F. (Red). Verklarende handwoordeboek van die Afrikaanse taal. Johannesburg: Perskor, 1985.

PON, K. Databasing in the elementary (and secondary) classroom. The computing teacher 12(3), Nov. 1983: 28-30.

SONNEKUS, M.C.H., FERREIRA, G.V. Die psigiese lewe van die kind-in-opvoeding. Stellenbosch: Universiteits-Uitgewers, 1979.

VAN PARREREN, C. Leren door handelen. Arnhem: Van Walraven, 1983.

VON SOLMS, S.H. Die ABC van rekenaars. Johannesburg: International Magazine Distributors, 1985.

TRENDS IN COMMUNITY EDUCATION AND THEIR RELEVANCE TO THE PROVISION OF COMMUNITY EDUCATION IN SOUTH AFRICA

G.D. KAMPER

1. INTRODUCTION

Community education is a relatively new concept in South African education, although it has been practised for many years (possibly unobserved). For the purposes of this paper we shall accept the following working definition of community education:

Community education is adult education presented in and confined to the locality of a particular community.

The definition is based on two key concepts - adult and community - which require more precise definition:

* Adult. In the context of community education a person is regarded as an adult if he or she conforms to the two criteria for adulthood laid down by Knowles (1980 : 24):

  - A sociological criterion: "(A) person is adult to the extent that that individual is performing social roles typically assigned by our culture to those it considers to be adult - the roles of worker, spouse, parent, responsible citizen, soldier, and the like."

  - A psychological criterion: "(A) person is adult to the extent that that individual perceives herself or himself to be essentially responsible for her or his own life."

* Community. Because of its comprehensiveness the following definition by Boyle (1980 : 92) is regarded as particularly useful for community education: "A community is based on the social interdependence that arises from the association of people in some geographical location. Depending on the nature of the problem to be addressed and the extent of interdependence, a community may be a small neighbourhood or the entire world."

117

In view of our postulated working definition community education may be said to include, to a greater or lesser extent, the education provided by such agencies as technical colleges, training centres and community learning centres.* In terms of this view it is evident that community education covers much of the field of adult education as depicted below (see Figure 1).

Figure 1 assumes that in any given place and age education and educational research (respectively) are always based on demonstrable schools of thought and/or paradigms which are particularly pertinent to education in that period and/or scientific community.

Since community education is experiencing a tremendous upsurge all over the world and a similar development may be anticipated in South Africa, it is important to take cognizance of some general trends in this field, particularly since South African society is no longer simply multicultural but increasingly displays multi-ideological traits as well.

2. A TYPOLOGY OF MODELS OF COMMUNITY EDUCATION

Jarvis (1985 : 157-158) distinguishes the following four approaches to community education:

- Conservative. Community education is provided for the exclusive purpose of maintaining the socio-political status quo. This approach "requires or allows for no theory of social change".

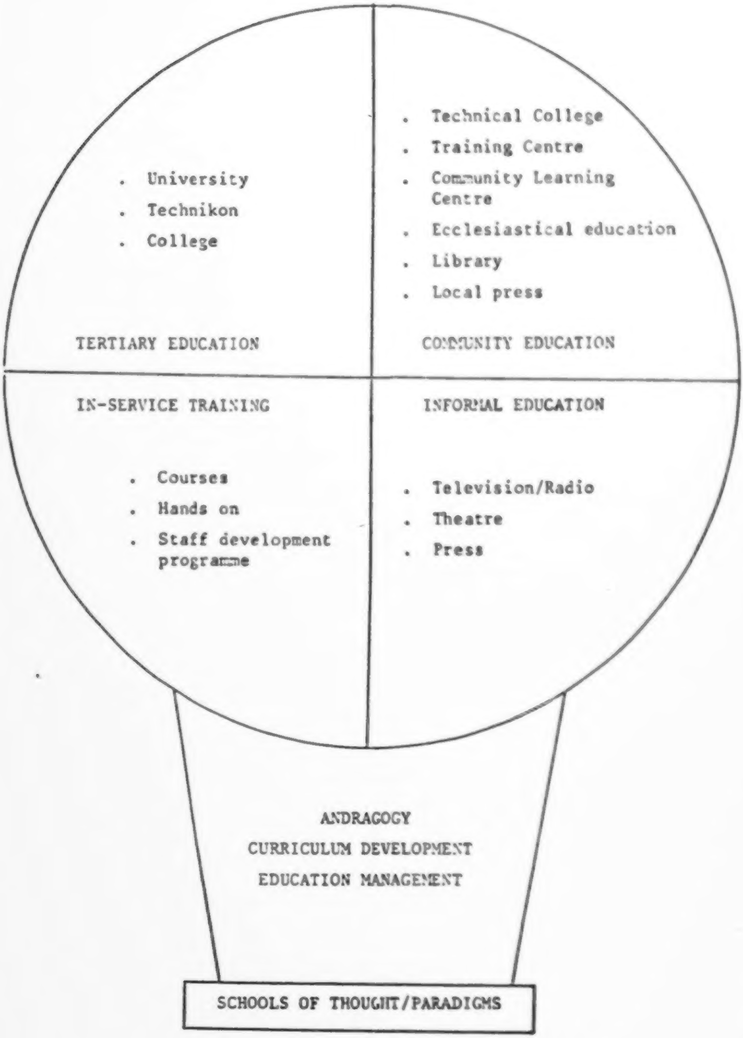
- Liberal. The main concern in community education is the individual with his distinctive educational needs and preferences.

---

* A community learning centre is an educational institution which is (ideally) controlled by the local community and which uses its own building, as well as existing facilities in the community (including those of schools), to provide a highly adaptable educational and training service tailored to the particular needs of (members of) the local community.

FIGURE 1

FIELD OF ADULT EDUCATION


University
Technikon
College
TERTIARY EDUCATION
Technical College
Training Centre
Community Learning Centre
Ecclesiastical education
Library
Local press
COMMUNITY EDUCATION
IN-SERVICE TRAINING
Courses
Hands on
Staff development programme
INFORMAL EDUCATION
Television/Radio
Theatre
Press
ANDRAGOGY
CURRICULUM DEVELOPMENT
EDUCATION MANAGEMENT
SCHOOLS OF THOUGHT/PARADIGMS

- Reformist. Community education is based on a moral motive of service and is strongly development-oriented, its ultimate concern being the welfare of the individual, the community and the state.

- Radical. Community education is highly politicised and conflict oriented, and is aimed at questioning and ultimately changing existing social structures.

This distinction is fairly consistently made in the literature on community education. In order to define the different shades of opinion more precisely, it is necessary to simplify Jarvis's classification somewhat by means of the following typology of models of community education:

- A liberal model
- A progressive model
- A radical model.

We shall discuss each of these models in turn.

2.1 A LIBERAL MODEL OF COMMUNITY EDUCATION

2.1.1 Perspective on adult education

The liberal model is characterised by a recreational perspective* on adult education, which is seen as a commodity (Jarvis 1985 : 184) serving mainly as an "outlet of interest" (Austin & Moore 1984 : 15). Community development as such does not feature prominently in this model, so that its social orientation could be described as static and uninvolved.

---

* Recreation : Agreeable, voluntary leisure-time activities of intrinsic value to (and for the personal satisfaction of) participants, promoting their physical and/or mental well-being.

2.1.2 Perspective on the adult learner

It is assumed that adults have particular interests and needs in regard to recreation, and that opportunities should be created (inter alia through the provision of education) to cater for these interests and needs. The decision whether to enter for a course or not is entirely up to the individual. On the whole this model is not directed towards the general educational welfare of the adult learner.

2.1.3 General curriculum

The needs and interests of individuals in regard to (creative) leisure-time activities and personal development are anticipated and catered for in a teaching programme. The accent is on creativity and "self-help".

2.1.4 Method of providing education

Provision of education in the liberal model of community education is characteristically market-oriented. Course content is exclusively determined by considerations of supply and demand. Fees for courses (where applicable) are often fairly stiff, since course leaders are normally (generously) remunerated. In assessing the success of a course the "enrolment criterion" is decisive.

Community education based on the liberal model may be presented in such venues as church and community halls, libraries and private homes, but they could also be part of the educational programmes of technical colleges, community learning centres and bureaux for continuing education at universities.

2.1.5 Evaluation

The liberal model clearly has a fairly narrow perception of the role and function of community education. Its recreational perspective has come in for (sometimes vehement) criticism from people "who attack the service for what they see as its triviality; the flower arranging/antiques image is very persistent" (Mee 1980 : 3). According to Tietgens

121

(1970) the following are typical features of this narrow view of community education (Jüchter 1970 : 5):

* Zufällige Improvisation
* Verdünnte Popularisierung
* Wenig selbstverständlich.

The market-oriented approach of this model implies that its provision of community education is fairly exclusive or eclectic - according to Mee (1980 : 3) it offers a "highly priced leisure service for the well-off". (It should be noted, however, that the market-oriented approach does not necessarily imply monetary profit but also "profit" in terms of, for instance, good relations. Consequently the liberal model of community education often offers recreational courses and/or social assistance to less privileged people.)

2.2 A PROGRESSIVE MODEL OF COMMUNITY EDUCATION

2.2.1 Perspective on adult education

The progressive model for provision of education is characterised by a need and developmental perspective, as illustrated by the fourth of the Principles for the provision of education in the RSA (HSRC 1981 : 15).

Provision of education is characteristically based on a service ethic, a "moral ought" (Jarvis 1985 : 199), clearly evident in the first of the above-mentioned Principles for the provision of education in the RSA (HSRC 1981 : 14). The same service ethic is apparent in cases where the private sector becomes actively involved in the provision of education. The Urban Foundation of South Africa[*] justifies its involvement in non-formal education in South Africa as follows: "... to improve the quality of life of South African communities, particularly in an urban context", and "to contribute to the establishment of a society founded upon justice and the explicit recognition of the dignity and freedom of individuals" (Urban Foundation 1982 : 5).

---

[*] The Urban Foundation of South Africa is a community development organization with extensive infrastructure financed and supported mainly by the private sector.

In Eastern bloc countries the progressive model is likewise the basis for adult education: "The basic aim is an all-round creative development of the personality" (Savicevic 1981 : 40). A dialectic unity between education, science and production is assumed (Savicevic 1981 : 44).

The developmental perspective adopted in the progressive model entails a direct relation between provision of education and community development:

"Community development is, in itself, an important educational process and at the levels of informal and non-formal education, it is perhaps one of the most effective educational agencies. The broad aims of community development are ... to promote a motivated future-orientated society within which new skills and a new sense of self-reliance can be cultivated" (Verster 1983 : 25).

In view of the above, the social orientation of the progressive model of community education may be described as developmental and uplifting.

2.2.2 Perspective on the adult learner

Andragogics, a part-discipline of pedagogics, originated largely within the progressive model of adult education. Knowles (1980 : 44) lists four andragogic premises relevant to adult learners:

"These assumptions are that as individuals mature:

1) their self-concept moves from one of being a dependent personality toward being a self-directed human being;

2) they accumulate a growing reservoir of experience that becomes an increasingly rich resource for learning;

3) their readiness to learn becomes oriented increasingly to the developmental tasks of their social roles; and

4) their time perspective changes from one of postponed application of knowledge to immediacy of application and accordingly, their orientation toward learning shifts from one of subject-centeredness to one of performance-centeredness."

The following view of community education expressed by Wlodkowski (1985 : 6) is very important : "... adults by definition, learning theory and social research are responsible people who seek to build their selfesteem through pragmatic learning activities in which their competence is enhanced."

The above views of adulthood are clearly indicative of a developmental perspective and are widely accepted in the context of community education.

Since the state features prominently as a provider of education according to the progressive model, its perception of the adult learner is important. Here one may cite the three objectives of general education policy as set out in the White Paper on the Provision of Education in South Africa (1983 : 1). These are

- to realize the potential of all inhabitants of the RSA
- to promote economic growth in the RSA, and
- to improve the quality of life of inhabitants of the RSA.

From this we can make the following inferences concerning adult learners:

- The state acknowledges its share of the responsibility to support adult learners and help them realize their potential.

- Adult learners have a rightful claim to provision of education.

- Adult learners are regarded as an investment with a view to national economic growth.

- The state can promote social stability by improving the quality of life of adult learners through provision of education.

The last inference in particular may be seen as the crux of government's perspective on the adult learner. This same motive may be assumed to underlie the private sector's involvement in education.

2.2.3 General curriculum

The general curriculum in terms of a progressive model of community education naturally places the emphasis on

- training courses, and
- (compensatory) formal education to improve school qualifications.

In view of this, it follows that the general curriculum of this model will be characterised by a "certificate-orientation" (Jarvis 1985 : 125).

In Eastern bloc countries a further important component of the general curriculum is the political education of adult learners (Savicevic 1981 : 63).

2.2.4 Method of providing education

The progressive model leaves the provision of infrastructure for education partly or entirely to the state. (We have pointed out that the private sector in capitalist societies has a special interest in the provision of education and contributes substantially towards it.)

In terms of the progressive model community education may be presented by a variety of agencies, of which the following South African examples are fairly typical: technikons, technical colleges, (state subsidised) technical training centres, community learning centres, bureaux for continuing education at universities and (state subsidised) training centres in the private sector.

2.2.5 Evaluation

It may be accepted that throughout the world community education is predominantly based on the progressive model, particularly because the state (and, where applicable, the private sector) has a stake in it. Consequently criticism of this model is levelled mainly at the (covert) "political" motives underlying it:

> "Clearly, it is politically appropriate to be demonstrating that access to the educational system is open to everybody throughout their lives, so that an appearance of egalitarianism occurs. ...

> This gives society an appearance of openness and consequently legitimates the social structure" (Jarvis 1985 : 200).

The progressive model is based on a (paternalistic) approach of "education from above". In this regard Mee (1980 : 3) rightly avers that in the field of community education the users of the educational service (e.g. "those who use the service to acquire a skill, to combat loneliness, to help compensate for their physical, mental, educational or social inadequacy;...") should have a say in the provision of education. "Unfortunately, the views of students are rarely sought" (Mee 1980 : 3).

Another criticism worth noting is that the progressive model places the emphasis too one-sidedly on knowledge and skills:

> "It is not enough to be a knowledgeable, skillful (sic) and well-informed adult person. It is necessary to be a critically thinking person with a broad view of the world, who is willing and able to estimate social consequences of his doings" (Kekkonen 1985 : 5).

To sum up: the progressive model of community education may be seen as an approach to and a form of education which, although taking account of the adult learner's developmental potential, is ultimately concerned with social and economic development for the sake of maintaining and advancing an existing order.

2.3 A RADICAL MODEL OF COMMUNITY EDUCATION

2.2.3 Perspective on adult education

The premise of the radical model of community education is the global crisis of hunger, poverty and mistrust:

> "The development euphoria of the two decades after 1945, together with the aid and trade palliatives of the third decade, have (sic) collapsed in the 1980s into the aggressive assertion of unenlightened self-interest by the wealthier and more powerful nations

> of the world both against one another and more particularly against the poor and the marginalised. Rather than being a time in which the long-promised benefits of development are finally made available to all, or even when the worst effects of underdevelopment are moderated by humane social policies, the 1980s are the contemporary high point of global suffering" (Kassam & Healey 1984 : 237).

The view expressed here means that adult education is assigned a special function. Kekkonen (1985 : 4) gives the following quotation from the final report of the Unesco conference on adult education, held in Tokyo in 1972:

> "... in order to have education act as an efficient instrument of change, adults must take active part in it. The goal should be to improve living conditions and general quality of life. Apathy, poverty, diseases and hunger are the biggest human drawbacks, calamities of today's world. They can be uprooted only by making people aware of what causes them and how they can be defeated."

This view of adult education as an agency of social change has its most forceful exponent in Paulo Freire, whose educational philosophy is based on the notion of the "politically liberating potential of adult education". This approach has led to an extensive "popular education" movement, mainly in Latin America:

> "Popular education involves the most deprived and oppressed sectors of a population, and seeks to engage them in a critical reflection on their daily concerns and social reality in order to achieve new levels of consciousness, and to build capacities for collective action" (Kassam, Healey 1984 : 243).

A variant of the educational perspective of the radical model is the movement known as "education for peace". Global armament and the arms race between the super powers have led to an "insanely overarmed world" with a steadily growing possibility of the mass extinction of human life (Kassam, Healey 1984 : 239). In addition this is accompanied by a considerable degree of so-called "structural violence" which likewise demands a peace offencive:

> "Peace means absence or minimization of both armed and structural, the so-called hidden violence, i.e. hunger, racial oppression, unemployment, threat of nuclear war, and inequality. To say it briefly: peace means achievement of justice. Realization of the world's drawbacks and investigation of their causes are already part of education for peace" (Kekkonen 1985 : 6).

To sum up, the radical model of community education focuses on social change by means of education as a process of socio-political sensitisation. Its social orientation could therefore be described as revolutionary and displays clear neo-Marxist features (more about this later).

2.3.2 Perspective on the adult learner

The target group of adult learners envisaged in the radical model is entirely Third World, "where the dominant elite exercise power in a much more overt manner than they do in some other parts of the world" (Jarvis 1985 : 111). The adult learner is sensitised to influences dominating his situation, and is led to experience the reasons for these as problems:

> "Problem-posing education affirms men as being in the process of becoming - as unfinished, uncompleted beings in and with a likewise unfinished reality. Indeed, in contrast to other animals who are unfinished but not historical, men know themselves to be unfinished; they are aware of their incompleteness and this awareness lie the very roots of education as an exclusively human manifestation" (Freire, as quoted by Jarvis 1985 : 113-114).

The premise that the maximum number of people should be made aware of themselves and their life-world as being "unfinished" and "incomplete" means that the radical model leaves the adult learner a lesser degree of choice concerning participation in educational programmes and/or curriculum content than the other models. One could therefore say that participation is seen as something of an imperative. In addition the accent is on the adult learner in a group context rather than on the individual learner.

2.3.3 General curriculum

The cornerstone of the general curriculum of the radical model is Freire's concept of conscientization: " ... the effort to enlighten men about the obstacles preventing them from a clear perception of reality" (Freire 1972, as quoted by Jarvis 1985 : 68).

This conscientization* permeates the general curriculum. In a literacy programme, for example, it features thus:

> "If learning to read and write is to constitute an act of knowing, the learners must assume from the beginning the role of creative subjects. It is not a matter of memorizing and repeating given syllables, words and phrases, but rather of reflecting critically on the project of reading and writing itself, and on the profound significance of language" (Freire 1972, as quoted by Jarvis 1985 : 113).

Kekkonen (1985 : 7) also refers to this "permeability principle" (i.e. to have some element permeate through each subject taught) and proposes, with reference to "education for peace", that appropriate elements ("such as explaining causes of wars and conflicts, ... getting acquainted with the interdependence of humankind and familiar with various forms of international co-operation, ... learning about peace movements...") should be integral to course curricula.

It should be noted that in this model the needs basic to the general curriculum do not normally derive spontaneously from the users of education but are suggested to him. Accordingly the course leader fulfils the role of a "problem setter" rather than a "problem solver" (Jarvis 1985 : 113).

---

* A basic tenet of neo-Marxist thinking on society is the following : one has to dissociate oneself mentally from the established order in order to mentally destroy that order (Du Plessis 1982 : 11).

2.3.4 Method of providing education

Because of the anti-establishment approach of the radical model, provision of education is entirely a matter of private initiative. In Latin America churches are particularly active in this field. Other providers of education come from the ranks of Unesco-backed educational organisations or radical left political organisations. The method of provision consistently professes to purvey "education of equals".

2.3.5 Evaluation

A striking feature of the radical model of community education is its marked Third-World orientation. Duke (1981 : 29) observes in this regard that the impact of Paulo Freire's educational philosophy on Australia's affluent society was minimal, "though its applicability, especially for aborigines, seems clear". Because of the priority given to education for the educationally deprived, community education in terms of this model has a particular (one-sided) connotation. Coombs (1985 : 34) rightly comments:

> "For any society to progress, numerous people who may have had many years of formal schooling and who hold important positions ... must continually learn new techniques in order to ... become proficient in their word. Indeed, in no few situations, priority must first be given to the key planners and implementers of programmes aimed at helping the needy and disadvantaged before such programmes can be successfully launched."

Another negative implication of radical educational philosophy is mentioned by Northmore (1986 : 184) : "... it pays insufficient attention to content and underestimates the ability of people to undertake more sustained intellectual study." In other words, it does not create sufficient opportunities for "intellectually demanding work".

To sum up, the radical model may be said to rest on the assumption that "those who have been educated will become revolutionary" (Jarvis 1985 : 115). The assumption stems from the (utopian) ideal of an egalitarian society (Jarvis 1985 : 112) - with education as a major instrument towards its achievement. This ideal arises from the neo-Marxist doctrine of the "Great Refusal" whereby existing social structures have to be radically changed and even overthrown (Du Plessis 1982 : 2-3).

3. RELEVANCE OF PREVAILING TRENDS IN COMMUNITY EDUCATION FOR THE PROVISION OF COMMUNITY EDUCATION IN SOUTH AFRICA

3.1 CURRENT SITUATION IN SOUTH AFRICA AS REGARDS THE LIBERAL, PROGRESSIVE AND RADICAL MODELS OF COMMUNITY EDUCATION

Community education in terms of the liberal model occurs on a very limited scale in South Africa, for the following reasons:

(a) The approach is peculiar to an affluent society.

(b) Only a relatively small percentage of the South African population could be described as affluent.

Normally the organization and presentation of community education in terms of the liberal model is a-structural and informal.

In South Africa the progressive model of community education predominates at this stage. As is the case in all developing countries, there are sound reasons for this. From the angle of development South Africa has a formidable backlog in the levels of schooling and education of its overall population. Any progress towards wiping out this backlog is directly influenced (and, in present-day South Africa, hampered) by the dynamic interaction between political and economic forces. Because of the state's (and, where applicable, the private sector's) direct contribution to and stake in community education, provision is given high priority and funds are consequently increasing steadily.

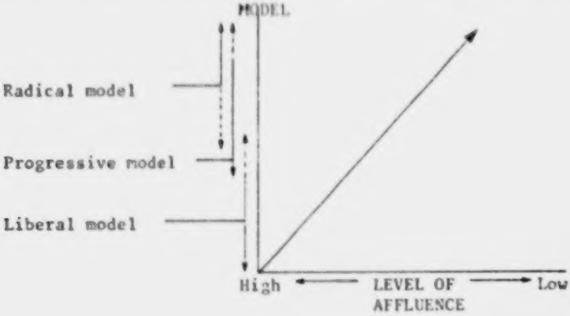
The indications are that community education based on the radical model is becoming a real force mainly in Black residential areas, where the radical left is taking the initiative in incorporating "people's education"[*] into the general secondary school curriculum. Both the extent of people's education and the measure of its current focus on adults are hard to determine, but as a new factor on the South African educational scene it can no longer be ignored.

3.2 A SCENARIO FOR THE DEVELOPMENT OF COMMUNICATION IN SOUTH AFRICA

The following diagram outlines a scenario for the development of community education in South Africa.

FIGURE 2

RELATION BETWEEN LEVEL OF AFFLUENCE AND MODEL OF COMMUNITY EDUCATION



Given the population structure and distribution of wealth in society, the following theoretical hypotheses may be postulated as a scenario for the development of community education in the country:

---

[*] "A main concern with the position of People's Education, as it is articulated at present, is the clear presence of an underlying tension between the statements on critical and creative thinking, active participation, democrative practices on the one hand and implied alternative ideological pressures, educational controls and 'power' issues on the other" (Hartshorne 1986).

- The liberal model will continue to maintain a low profile as a spontaneous, informal method of providing education in certain communities but with little or no relevance for the overall educational system.

- the progressive model (irrespective of the nature of political and social changes in South Africa) will remain the dominant approach to community education and will become increasingly more prevalent. It can be assumed that the Western-oriented developmental approach to community education will increasingly have to compete, particularly among the lower income groups, with the radical approach (see Figure 2).

- As for the radical model, it is anticipated that it will flourish in the short and medium term due to the revolutionary climate in various residential areas. The eventual intensification or abatement of the revolutionary climate will determine the expansion of community education according to the radical model, but in view of the prevailing social stratification in South Africa its potential impact cannot be ignored (see Figure 2).

4. SUMMARY

To sum up, the following points can be made about the various models of community education and their relevance for (the development of) such education in South Africa:

- There are marked differences of opinion about the goal and function of community education.

- In our discussion of the liberal, progressive and radical models of community education certain deficiencies of each model were pointed out. These weaknesses in effect mean that

  (a) some motive other than concern for the adult learner or adult education predominates

(b) the provision of community education is often eclectic and selective.

(c) utopian expectations are cherished concerning the education of adult learners.

- A multi-cultural, multi-ideological society such as the South African one requires a model of community education that will
  - be as far as possible (and if possible) a-political and a-ideological
  - give priority to the social and in particular the mental welfare of the individual in a particular situation, and therefore pay due attention to the development of life skills
  - proceed from a realistic (non-utopian) perception of the adult learner, instead of the (prevailing) idealistic conception "that disregards human helplessness, dependency, irresponsibility, confusion, and irrationality" (Carlson 1981 : 175)
  - perceive the adult learner as a rich source of knowledge without necessarily considering his formal qualifications*
  - be non-discriminatory as regards target groups
  - permit participation in management and curriculum development

---

* Jarvis (1985 : 195) rightly remarks that a person without a certificate is universally regarded as being without education, even though "an individual ... can think some of the profoundest thoughts and achieve some of the greatest insights into human behaviour. He can read some of the best books and understand a wide range of disciplines. In short, he can be a very learned person".

- honestly allow for the possible negative effects of educative intervention (e.g. false hopes and/or irrelevant knowledge) when evaluating the desirability, feasibility and potential success of the provision of community education in certain conditions. The happiness of the adult learner should be the prime consideration and this may be jeopardised by "diagnosis" of "educational problems": "This very concern for diagnosing 'problems' reflects a philosophical bias that views scientific intervention as appropriate to all areas of human interaction, even when such interference may destroy the human essence of those interactions" (Carlson 1981 : 181).

It may be posited that community education based on the above premises will help to make *l'education permanente* a prominent feature of the provision of education in South Africa.

REFERENCES

AUSTIN, G.W., MOORE, G.E. Community schools in transition: A new model evolves. *Education Canada* Winter 1984 : 15-19.

BOYLE, P.G. Adult educators and community analysis. In : BOYD, R.D., APPS, J.W. *Redefining the discipline of adult education*. San Francisco : Jossey-Bass, 1980 : 89-98.

CARLSON, R.A. The foundation of adult education : Analyzing the Boyd-Apps model. In : BOYD, R.D., APPS, J.W. *Redefining the discipline of adult education*. San Francisco : Jossey-Bass, 1980 : 174-184.

COOMBS, P.H. Suggestions for a realistic adult education policy. *Prospects* XV(1), 1985 : 27-38.

DUKE C. Australia in Asia - comparison as learning. In : CHARTERS, A.N. *Comparing adult education worldwide*. San Francisco : Jossey-Bass, 1981.

DU PLESSIS, L.M. Die neo-marxiste - 'n heilige familie? *Studiestuk 171, Instituut vir Reformatoriese Studie*. Potchefstroom : PU vir CHO, 1982.

HARTSHORNE, K.B. Education beyond apartheid. *Sunday Times*, 21 September 1986.

HUMAN SCIENCES RESEARCH COUNCIL. *Provision of education in the RSA*. Pretoria: HSRC, 1981.

JARVIS, P. *The sociology of adult and continuing education*. London : Croom Helm, 1985.

JÜCHTER, H.T. *Programmierte Erwachsenenbildung*. Braunschweig : Georg Westermann Verlag, 1970.

KASSAM, Y., HEALY, P. Adult education in a rapidly changing world. *International Review of Education* Vol. XXX, 1984 : 237-246.

KEKKONEN, Helena. Of adult educators' responsibility for peace. *Newsletter*: *Adult Education Clearing-house* XIII(5), May 1985 : 4-10.

KNOWLES, M.S. *The modern practice of adult education*. Chicago : Association Press, 1980.

MEE, G. *Organisation for adult education*. London : Longman, 1980.

NORTHMORE, S. A community development model of adult education. *Community Development Journal* 21(3), July 1986 : 181-185.

REPUBLIEK VAN SUID-AFRIKA *Witskrif oor onderwysvoorsiening in die RSA*. Pretoria : Staatsdrukker, 1983.

SAVICEVIC, D.M. Adult education systems in European socialist countries: Similarities and differences. In : CHARTERS, A.N. *Comparing adult education worldwide*. San Francisco : Jossey-Bass, 1981.

URBAN FOUNDATION OF SOUTH AFRICA. *Design study for the provision of nonformal education in South Africa*. Draft report, 1982.

VERSTER, J.M. *The stimulation of formal, informal and non-formal education in South Africa*. Report submitted to the Science Committee, President's Council. Johannesburg : National Institute for Personnel Research, 1983.

WLODKOWSKI, R.J. *Enhancing adult motivation to learn*. San Francisco : Jossey-Bass, 1985.

GUIDELINES FOR THE FORMULATION OF OBJECTIVES AND THE SELECTION OF LEARNING CONTENTS FOR BASIC EDUCATION IN THE RSA

L. PIENAAR

1. BACKGROUND

During 1981 the Main Committee of the HSRC Investigation into Education (HSRC 1981) proposed a phase of basic education (the second phase in a new educational structure) for all the population groups in the RSA. No comprehensive research with a view to clearing up obscurities and thus hastening its implementation, should it be approved by government has as yet been done on this educational phase. That there is at present a degree of hesitation and waiting is not strange as a great deal of reflection on various proposals for educational renewal is normally essential, before these are applied in practice.

An exploratory study on certain aspects of basic education was completed by the HSRC in 1985. The research report included guidelines regarding objectives and learning contents (Pienaar 1985). These will be referred to in Paragraphs 3 and 4.

South Africa's multicultural population composition together with the fact that the RSA is at the same time a developed as well as a developing country, means that guidelines for learning objectives and learning contents have to be devised that take into account the educational needs of the country as a whole and of the different communities in particular. In developing countries where educationists have to bear in mind distinctive, mainly survival-related issues such as poverty, wholesale illiteracy, hunger and unemployment, such a predominantly pragmatic perspective will have only limited value for education in the RSA. Indeed in some developing countries education is not provided on the basis of fundamental pedagogical considerations at all. The premise is rather that education is the key to economic development - a premise that in the course of time has been shown to be erroneous because education on its own can never guarantee such development. In such a case education is consequently not an aim in itself but rather a means to an end.

In a largely developed country like the RSA with a predominantly Western culture, educational renewal should be concerned mainly with keeping (or getting) up to date with developments in many areas. Consequently basic education will focus more on ways in which education can prepare pupils for these developments as well as others that are foreseen. That this is an exhaustive and topical task emerges clearly from the everyday use of terms such as "technological literacy", "computer literacy", "information explosion", "media science" and "intercultural communication", which are cropping up increasingly in the identification of educational needs. These terms or concepts are the expression of developments that have taken place, that will probably increasingly take place and that are directly related to the provision of education.

2. EXPLANATION OF THE TERM "GUIDELINES"

The choice of the term guidelines casts some light on the contributory or underlying factors that may play a role in the formulation of certain objectives and learning contents for basic education. Objectives and learning contents are fundamental to all education and are closely related to endeavours to raise the educational level of the population as a whole, to improve the quality of life and to satisfy the manpower needs of a country. Guidelines also refer to what can be regarded as essential to or characteristic of objectives and learning contents and they indicate what demands - pedagogic or economic - such objectives and contents must comply with. In addition guidelines serve as criteria to assess the validity and suitability of objectives and learning contents in basic education.

3. GUIDELINES FOR THE FORMULATION OF OBJECTIVES

3.1 PEDAGOGIC GUIDELINES

From a South African perspective basic education should in the first place be pedagogically accountable. It is assumed that the child in his totality, and in accordance with certain values and norms that he ought to embody as an adult, should be educated to take his place in the world in its totality. The explicit statement here is that the child and his education should not be surrendered or subordinated to the demands of a particular consideration, for example technology or the labour market; but at the same time it does not mean that he should be educated in isolation from such factors.

3.2 THE PHILOSOPHICAL GUIDELINE

It is unthinkable that a child should be educated/instructed without bearing the stamp of a particular attitude to life, normally and preferably that of the cultural community to which he belongs. In the South African setup different philosophies of and attitudes to life are encountered. Although they are sometimes divergent they also have points in common. During the proposed phase of six years of basic education (cf. Diagram 1) the transfer of the philosophical approach to life that is in keeping with the child's cultural background should be paramount; however, points of contact and communal values and customs such as religion and language should also be built upon.

3.3 THE DEMANDS OF CONTEMPORARY LIFE AS GUIDELINE

That changes and developments in different spheres of life in the world and in South Africa are taking place - and at an increasing tempo - is incontrovertible. At the same time new and greater demands are being made on the child as an adult-in-the-making - demands that education has to be in step with in order to remain meaningful and relevant. An objective of basic education should, in the light of rapid developments, not only be to keep abreast of these developments but in particular to provide timely responses to developments that can be anticipated. In this way education can be prevented from merely marking time.

3.4 ATTAINABILITY OR FEASIBILITY AS GUIDELINE

Other than in the case of traditional primary education, the learning contents for basic education are presented in a differentiated way. This means that objectives for the different "packages" for different class groups (cf. Diagram 1) may vary. Bearing in mind the administrative, practical and financial implications that differentiated basic education may have for educational praxis, objectives should be

139

formulated in such a way that they can either be realized during the phase of basic education or, if this is not possible, continued within the postbasic educational phase (during which time education is compulsory for the child for a further three years).

DIAGRAM 1 : PROPOSED MODULAR EDUCATIONAL STRUCTURE

		Degrees of differentiation in basic education				
LEVELS	6 (Std 4)	6,0	6,1	6,2	6,3	6,4(a)
	5 (Std 3)	5,0	5,1	5,2	5,3	5,4
	4 (Std 2)	4,0	4,1	4,2	4,3	4,4
	3 (Std 1)	3,0	3,1	3,2	3,3	
	2 (Sub B) (Grade II)	2,0	2,1	2,2		
	1 (Sub A) (Grade 1)		1			

(cf. HSRC 1981 : 115)

3.5 THE DEVELOPMENT POTENTIALITY OF THE CHILD AS GUIDELINE

Fresh thought should be given to the development potentiality of the child in the age group 6-7 to 12-13 - the six years of basic education. It should be borne in mind here that, in contrast to the position in primary education, the child has to be school-ready on entry into basic education. Because more advanced schoolwork can be commenced within Level 1 (cf. Diagram 1) of basic education than in Grade 1/Sub A (in the case of primary education), overburdening of pupils will have to be guarded against as will, on the other hand, expecting work of the same reach as formerly from pupils - thus leading to the setting of standards that are too low.

3.6 THE DURATION OF BASIC EDUCATION AS GUIDELINE

After the basic education phase has been completed pupils have to undergo at least another three years' compulsory education whether it be formal or non-formal. In the case of pupils who will receive occupation-oriented education as a form of in-service training in a non-formal context, the phase of basic education is in large measure their only exposure to formal education of a generally formative nature and as such it is a rounding-off phase for these pupils. At the same time the pupils must during this period also master certain skills to such a degree that they can be further developed in the course of continuing education either in a formal or non-formal context. Although not all educational objectives will be realized during the six years of basic education, meaningful progress must be made during this phase so that the aims of basic education can eventually be fulfilled.

3.7 THE NEEDS AND CIRCUMSTANCES OF THE RSA AS GUIDELINE

Because the primary task of the school is to prepare pupils for adulthood, the particular circumstances of the RSA in which the child will eventually find himself as an adult should be fully taken into account by the education system. Should there be an increasing need in the RSA for more occupation-oriented education to meet the demand for trained manpower, it is the task of education to make a significant contribution in this regard - but of course always within pedagogical parameters. The different religious, cultural, social and ethnic elements in the RSA - which for the sake of all the inhabitants should be in harmony - make special demands on education, and basic education in particular, to prepare pupils for South African circumstances.

For the sake of better intercultural understanding and better communication the institution of a third language, i.e. another official language or a black language, at least as a colloquial language, should enjoy greater attention and acceptance.

3.8 OBJECTIVES FOR BASIC EDUCATION SHOULD BE FLEXIBLE

The history of education shows that educational objectives have not remained static and immutable. A notable exception in this regard is the overarching objective, namely man's final destination in a religious sense. For the rest, objectives should have a suppleness and flexibility to enable them to keep in step with life's changes. In certain cases such as the attainment of full adulthood the objective will remain unchanged but the content will constantly change as adulthood time and again assumes different guises with the passage of time. Therefore the objectives of basic education should never claim to be final or universal.

4. GUIDELINES FOR THE SELECTION OF THE LEARNING CONTENTS FOR BASIC EDUCATION

Learning contents and objectives do not feature independently of each other in the provision of education. Without the one the other may be of academic interest but will be meaningless in practice. Accordingly the proposed guidelines for learning contents must correspond with those for objectives.

With the recommendation of guidelines for learning contents the aim is, as in the case of objectives in Paragraph 3, to identify criteria on the basis of which learning contents can be selected. The formulation or wording of the guidelines is a complex matter as different groups at a particular level (standard) have to be curriculated for - this task should be undertaken by curriculum experts, preferably from the teaching practice.

4.1 BALANCE IN THE COMPOSITION OF LEARNING PACKAGES AS GUIDELINE

Educating the child in his totality with a view to the attainment of full maturity means that the choice and ordering of learning contents must take place in a balanced way. A balanced composition of pedagogically accountable learning contents will have to take due account of religious, culturo-historical, cognitive, ethical, aesthetic, economic and pragmatic elements. Such a balanced mirroring of reality will rest on a choice between what subject matter a child should learn and what subject matter is desirable.

4.2 RELEVANCE OF SUBJECT MATTER AS GUIDELINE

There is considerable difference of opinion on the question of the relevance of certain learning contents because of the subjective nature of the matter : what is relevant for one person may for a variety of reasons be totally irrelevant for another person. Without referring in detail to specific learning contents, a basic criterion for relevance is that they should have a bearing on the child's world of experience and his anticipated involvement as an adult in the real world. The child should experience the subject matter that he encounters from day to day as meaningful and useful in the hope that this will lead to increasing initiative and enterprise on his part.

Relevance as a guideline in the choice of learning contents does not however mean a pragmatic predisposition towards only that which is serviceable and useful to learn. It also does not mean that pedagogical considerations should be put to one side and made subservient to secondary considerations such as the training of manpower for the labour market or technology.

4.3 THE LINKING-UP OR CONTINUITY PRINCIPLE AS GUIDELINE

Apart from other considerations the child should at the end of the basic education phase have a foundation of knowledge that can be built upon during the compulsory postbasic phase (either formal or non-formal) of at least three years. Other as in the case of primary education which merely has to prepare pupils for secondary education, during the basic education phase they have to be prepared for formal and non-formal postbasic education/training.

Consultation in the choice of subject matter and the composition of learning packages in respect of basic and postbasic education is essential to prevent pupils during the basic education phase from landing in a dead-end street, at least as far as certain learning contents are concerned. Basic education and postbasic education cannot be presented in isolation from each other. However, it must be understood that one cannot be prescriptive regarding the other, especially as far as the inclusion or exclusion of learning contents is concerned.

4.4 DIVERSITY AS A GUIDELINE IN THE CHOICE OF LEARNING CONTENTS

In 3.2 and 3.7 the diversity of the heterogeneous South African population was referred to concerning matters such as ethnicity, culture (religion, language and customs) and educational level. Apart from these differences, pupils also differ with regard to intellectual capability, aptitude and interest in respect of which differentiated education has not yet been provided.

According to the proposed modular educational structure (cf. HSRC, Main Committee, 1981, P.115), the educational needs of individual pupils can be optimally catered for by providing basic education on a differentiated basis in terms of the pupil's recognizable abilities, aptitude and interests. The composition of the different subject packages and the determination of the degree of difficulty of the subject matter should therefore be done expertly so as to meet the pupil's educational needs.

4.5 THE PROMOTION OF INSIGHT AS GUIDELINE

Man's ingenuity and creative ability are increasing and are making greater demands on education to keep abreast of new developments. This means that the ready knowledge that is mastered by the child at school merely through memorization will have limited value in practice unless it can be accompanied by greater understanding, the heightening of the imagination and increased creativity. Children will have to be taught anew how to study, what to study and how to apply acquired knowledge in new problem situations.

Subject matter that is aimed less at memorisation and more at the promotion of insight should be given preference during the basic education phase so that pupils can be adequately prepared to meet the demands of a complex future.

Bearing in mind all the above guidelines concerning objectives and learning contents, a package for learning and formative contents for basic education is proposed that in short takes into account the following aspects of knowledge:

(a) Religious forming
(b) Ethical forming
(c) Economic forming
(d) Aesthetic forming
(e) Self-preservation and survival
(f) Language literacy
(g) Media literacy
(h) Mathematical literacy
(i) Technological literacy
(j) Computer literacy
(k) Science literacy
(l) Occupational orientation
(m) Responsible citizenship
(n) Social orientation

5. SUMMARY

The idea behind the setting of guidelines for objectives and learning contents was merely to indicate the parameters that may be of importance in the planning and substantiation of a basic education praxis for the RSA. Taking into consideration the complex educational situation in South Africa that is characterized by diversity in culture, ethnicity, historical background and social, economic and political groupings, substance will have to be given to these guidelines by experts in the field of education.

REFERENCES

PIENAAR, L. *'n Ondersoek na die doel, aard en inhoud van basiese onderwys in 'n onderwyskundige struktuur: Riglyne vir 'n onderwyspraktyk*. Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1985.

Human Sciences Research Council. Investigation into Education. Main Committee. *Provision of Education in the RSA : Report*. Pretoria, 1981.

ENVIRONMENTAL ANALYSIS AS A FACTOR IN CURRICULATION

I. VAN DER STOEP

Curriculum development has a long history in formal education, and is the outcome of established, carefully verified operationalization procedures. The situations in which these curricula are implemented are on the whole homogeneous, being geared to educative teaching and the achievement of "academic" learning results. The traditional objective of curriculation in such a context is that learners should know (remember, work out, calculate, describe, explain, evaluate, etc.) certain things rather than that they should be able to apply such knowledge directly in order to create something. The situation analysis traditionally employed in this type of curriculation reveals that the initial operationalization is very much aimed at goals of this nature - as is readily apparent in Bloom's taxonomy (1964). It follows that the determinants functioning in ordinary situation analyses in traditional formal education derive from the curriculum developer's attempt to establish the parameters of his initial situation. This allows him to test the profile of his curriculum concepts against these parameters, which serve as a frame of reference. For this reason determinants such as life-view, educational norms, general life-style and the like invariably feature in any pedagogically oriented curriculum. They constitute the origin or basis of its identification of objectives, since the developer's consistent aim is to educate. An interesting point is that the analysis of learning needs rarely if ever feature in this phase (i.e. in the situation analysis) of curriculation procedures in formal education.

Although curriculation is assigned the same importance in non-formal education as everywhere else, it is not given the same articulated attention as in formal education. Nevertheless the development of training programmes has received constant, intensive attention and one cannot but observe that its planned development - for instance, in the industrial sector - derives directly from the organization's identified mission. As a result there is a close correlation between an enterprise's mission, which generates the determinants of its training programmes, and the actual development of these programmes. In formal education, where the mission is pedagogic, this is naturally the origin of its curriculum determinants. By the same token the determinants of curricula in the industrial sector spring from the missions of enterprises. From a curriculation point of view this is right and proper, just as the determinants of, say, a school curriculum rightly stem from pedagogic aims.

This raises an intriguing question: to what extent will the nuances of situation analyses in non-formal education differ from those in the familiar diagrams in current literature on curriculation? (See Steyn 1984, Gwynn 1960 and Frey 1971.) From the above one could fairly expect that curriculum development in training organized by enterprises will be based on their missions. In general terms a mission may be defined as "statements about the underlying design, aim, or thrust of a company ... a grand design (or) basic purposes or philosophies ... " (Bettil 1978). The way in which particularized objectives may be derived from such a mission is self-evident. Examples would include formulations such as the following:

- to become the most profitable company of its kind
- to embody high technical standards of the industry
- to maintain the highest ethical and moral behavioural standards in all activities
- to establish unquestioned leadership in its field by such means as research and training (Bettil 1978).

The obvious determinants to be inferred from these objectives would include the following: profitability, optimal utilization of available resources and manpower, high-level production development, sound labour relations and good career possibilities. These are all determinants that help to shape training and training curricula in terms of an organization's mission. For example, if the quality of a product is assigned priority in the formulation of the organization's mission, it seems that research, training of researchers and the development of effective training programmes for workers will likewise be priorities. Alternatively an organization could settle for effective product marketing as a priority, which would result in different determinants for the development of training programmes. The emphasis in the mission of the organization should tell curriculum developers what determinants should direct the development of training programmes.

In view of this one could well ask which factors play a part in correlating the mission of an organization with its training programmes or curricula. If one assumes that curriculum development in such a situation follows the same cycle as in traditional formal curriculum development, the following would appear to be significant factors:

* the entire infrastructure of the organization
* training priorities as inferred from the mission
* determination of learning and training needs in terms of these priorities
* development of training infrastructure, to include training programmes or curricula.

Naturally the development of such programmes will be based partly on information provided by a needs analysis and partly on a situation analysis. Among the many facets and perspectives involved in a situation analysis, the importance of the environment cannot be emphasized strongly enough. Not surprisingly, management literature consistently mentions environmental analysis as a means of identifying determinants for the overall strategy of an organization (Rue & Holland 1968). One such determinant might be training. If so, environmental analysis immediately becomes pertinent since its cardinal objective is to utilize the various attributes of the environment optimally to the benefit of the organization (Terry 1977) - more specifically, to link environmental analysis to curriculum development.

By this is meant that data about the environment are collected in order to identify and evaluate environmental influences which affect training. Obviously the size of the organization and the possible diversity of its activities will be relevant in this regard. The important thing, however, is that both the programmes and the actual training should allow for the facts emerging from the environmental analysis. For the purposes of this paper, an environmental analysis can be defined as follows:

> "The environment of an organization consists of the outside forces that directly or indirectly influence its goals, structure, size, plans, procedures, operations, input, output, human relations, and so on. Environmental analysis is the study of these forces, the relationships among them and their effects and potential effects on the organization" (Sergey 1979:58).

Such experts as Prakash and Sethi (1979) make it quite clear that an environmental analysis cannot be excessively quantified. A decisive factor in the interpretation of data is the interaction between man and environment, in which four determinants are of particular importance, namely politics, society, the economy and technology. These determinants (or systems) are interdependent and should be analysed in a way that will afford broad policy guidelines for matters such as training.

The *political environment* provides indicators such as the sources of political risk, factors generating political risk and the effects of political risk on training. By and large it creates the climate in which the form of predictable stability is identified. The curriculum developer will therefore look beyond the immediate environment of the organization and will interpret these data within the framework of local political forces with a view to constructing a multidimensional picture. An example of such an issue is the ever present traditional prejudices which surface politically whenever learners are selected for training.

In the same way analysis of the *social environment* discloses facts which make it possible to relate training to the social responsibility of the organization. Relevant factors here are proper integration of given juridical requirements such as labour laws, neutralization of harmful social influences and promotion of positive social change, for instance by improving quality of life through training initiated by the organization.

Naturally the *economic environment* usually has the most obvious impact. It concerns such matters as mobilization of the manpower potential of the organization, inspiring worker confidence in the immediate benefits of training for the individual, development of career possibilities for individual workers and the compatibility of the existing economic order with healthy social development (Thomas 1974). Economic considerations are probably the single most important factor motivating learners to undergo training. In this regard curriculum and career development presents not just a responsibility, but also possibilities which could have a substantial impact on the general well-being of the organization.

Technological development inevitably imposes itself on the planning of training in the environmental analysis (Schon 1967:759). Factors relevant to curriculum development in this regard may readily be summarized as all technology that will help an organization establish its pre-eminence in any respect whatever (Madden 1972:42). More explicitly, it is a matter of invention, innovation and dissemination. Without carefully planned training in this regard, no organization will make the grade competitively. This implies that technological development influences more than just the substance of training programmes, which it obviously affects. The conception of training as a future-oriented organizational strategy, underscores the special responsibility of curriculum developers by highlighting two dimensions in particular:

- new problems for the organization
- solutions to these within the organizational context.

Further sophistication of this broad framework permits one to isolate the following factors which should feature in an environmental analysis and with which the curriculum developer, in collaboration with the analyst and the strategist, should be conversant (Brown 1979:11):

- *Demographic data* relevant to the organization, for instance mobility of the population, role and circumstances of minority groups, job opportunities and employment, trade unions, distribution of income and housing. From a curriculum developer's point of view these data have implications for training conditions, for instance commuting, transport costs, distances travelled and residential distribution of workers.
- *Resources* relevant to curriculation include availability of training personnel, funds for training and curriculum development, time allowed by management for training and facilities (e.g. venue and apparatus).
- *Life-style* is a consideration, since it affects the selection of learners, retirement age, recreation and spending patterns.

Even the above particularizations still represent macrostructures and macroconcepts which may be used to determine general policy, trends and problems. Organizations have to deal with these matters in terms of their particular circumstances and therefore have to reduce them or render them applicable to their own microsituation - that is, to circumstances under the direct control of management. This necessitates categorization which directly implies a distinction between *external* and *internal* environmental factors. The points raised so far are almost exclusively associated with the external environment. The internal environment affects the organization as an entity in respect of both priorities and activities. One could say that its impact is qualitative, since it implies mainly short-term projections which can largely be regulated or manipulated by management - even on an annual basis. Relevant issues in this regard include the organizational growth rate, budget retrenchments, changes in production processes and the creation of new departments.

Evaluation of all these data (on both the external and the internal environment) is such a wide-ranging task that it is manifestly beyond the capabilities of any individual expert. Consequently the curriculum developer is heavily reliant on the diverse particulars of the external environmental (or macro-) concepts such as economic, social and demographic concepts, on the environmental analyst, the strategist and management generally. This implies that the corporate infrastructure of the organization should join forces to proceed from general macrostructures (systems) to the parameters within which training programmes have to be developed with a view to achieving optimal benefits for the organization. The following two diagrams (based on a model of Thomas (1974) as quoted) may help to clarify the discussion so far.

FIGURE 1

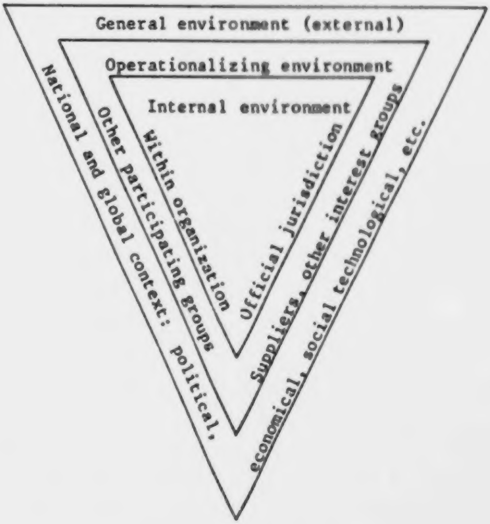
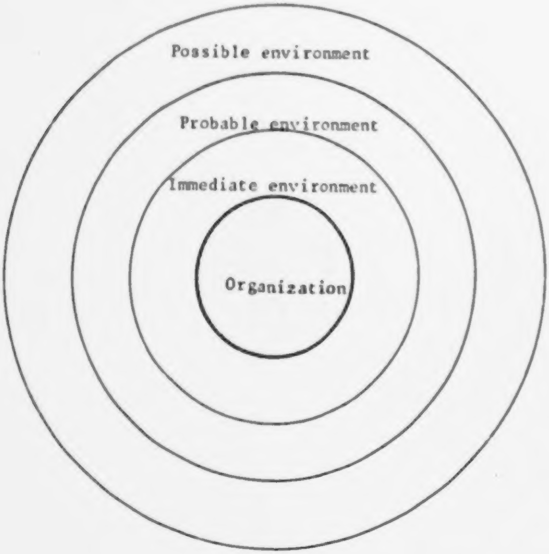

General environment (external)
Operationalizing environment
Internal environment
National and global context: political,
economical, social technological, etc.
Other participating groups
Suppliers, other interest groups
Within organization
Official jurisdiction

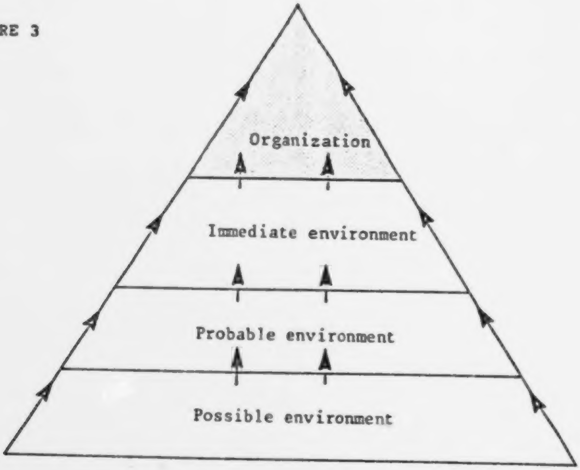
FIGURE 2

(Based on a model by Terry (1977) as quoted)


Possible environment
Probable environment
Immediate environment
Organization

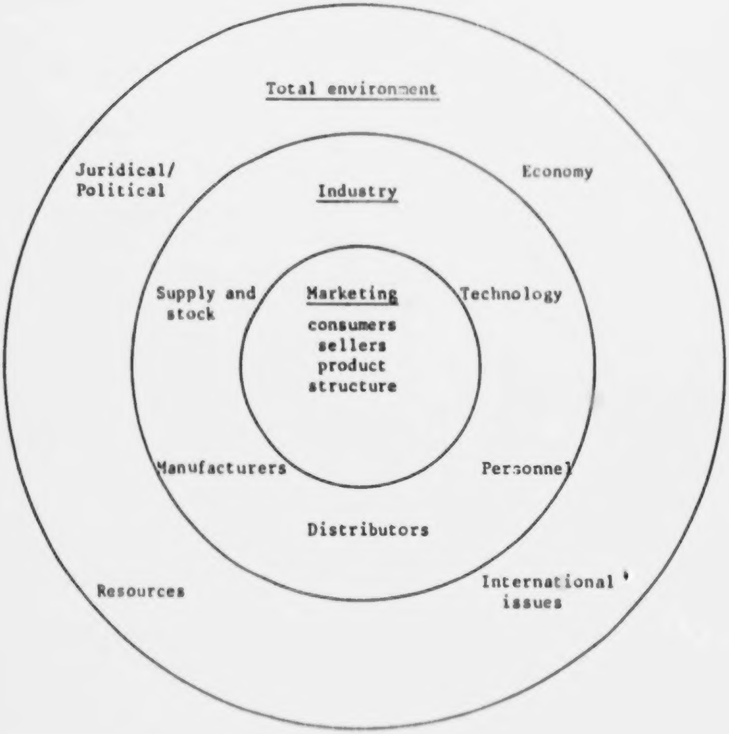
One could also draw a tiered pyramid, which would reflect the same information as follows:

FIGURE 3


Organization
Immediate environment
Probable environment
Possible environment

The following model by Bates (1985) gives the curriculum developer a clear overview of environmental factors relevant to organizational planning, which should be taken into account when developing training and training programmes.

FIGURE 4


Total environment
Juridical/ Political
Economy
Industry
Supply and stock
Marketing
consumers
sellers
product
structure
Technology
Manufacturers
Personnel
Distributors
Resources
International issues

Bates sees these as the three areas in which the environment of an organization has to be interpreted. There are clear parallels with the concepts of a general, an operational and an internal environment, and a possible, a probable and an immediate environment, as reflected in the previous diagrams.

Bates's (1985) great contribution to environmental analysis from a curriculation point of view is his MAP (Monitor, Analyse, Predict) model of operationalization. Without going into detail, the following outline and diagram of the model are illuminating:

- By *monitoring* Bates means a rapid, general survey of the environment, culminating in classification and interpretation of the data gained in terms of the internal organizational environment with a view to identifying two types of variables:

  (1) relevant variables
  (2) critical variables.

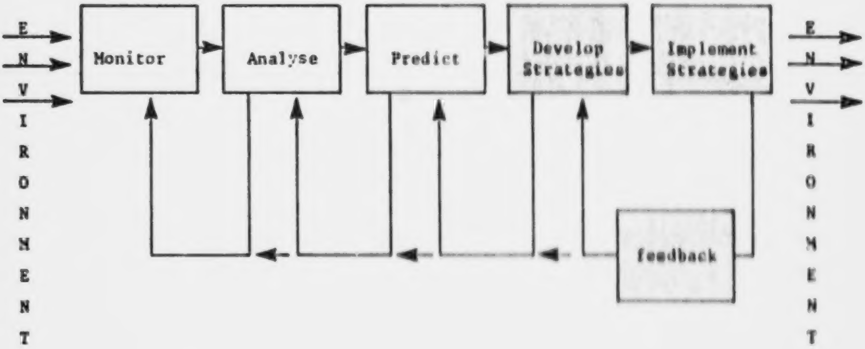
  What Bates has in mind is that the environmental analyst should take cognizance of trends or changes which could affect the organisation. This implies selecting relevant variables (i.e. those that are of current significance) from which he then infers the critical variables - those that will influence optimal organisational functioning. Identification and evaluation of these variables are the direct outcome or goal of environmental analysis.

- The next phase, *analysis,* is when management scrutinizes current organizational policy and, through consultation and research, evaluates its applicability to the future circumstances of the organisation. This analysis is conducted in the context of the operationalisation of the organization. After identifying important variables, their interrelationship is studied in order to make pro-active projections concerning future conditions. The curriculum developer is concerned with both the relations between critical variables and the economy, and the interrelationships between the critical variables themselves, but his main concern is the relation between critical variables and the organization as such (i.e. the internal environment) which could give training protocols pro-active significance.

- Bates' third phase is that of *prediction* or *anticipation*. This naturally concerns planning, optimal utilization of resources and sure identification of training needs with a view to conducting these future activities congruently with the future environment, *inter alia* through properly planned training. In all this the organization's research potential and the employment of reliable consultants are vitally important.

A diagram summarizing Bates' operationalization of the above three processes appears below (Bates 1985:99).

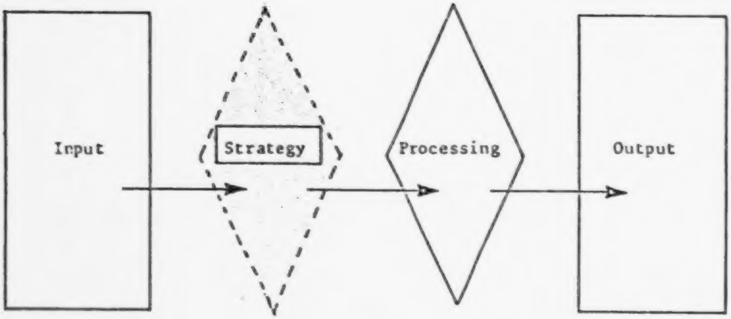
FIGURE 5



The curriculum developer's most obvious task and contribution to overall organizational strategy are in the area of strategy development, strategy implementation and feedback (evaluation).

The impression that the linear flow of data from environmental analysis inevitably comes to a halt in the development and implementation of strategy, is misleading. The task of establishing congruence between the two sets of data released by environmental analysis (those concerning the external and internal environments respectively) is directly linked with strategy development, of which training is a component. The following diagram shows the relation between external and internal environment and the role of strategy development in this regard:

FIGURE 6

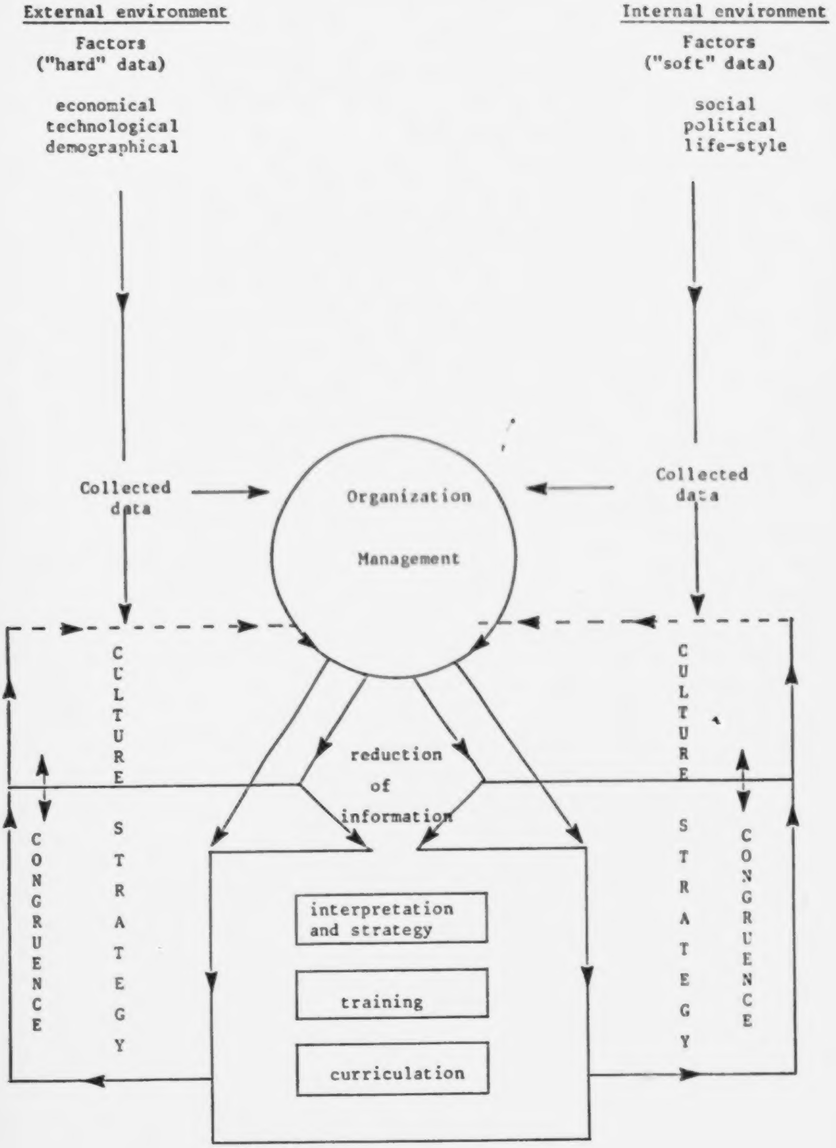


The inputs in question are the data released by the environmental analysis, which provide a profile of WHAT elements in the environment are significant for the organization. As we know, this concerns both the quantity and the quality of data. Quantitative or "hard" data reflect such things as economic trends, technological development, population growth, labour legislation and the like. Qualitative or "soft" data concern social trends, political developments, life-styles, corporate responsibility and the like. (In this regard see e.g. Argyris 1977: 115, Argyris 1973: 35, Schein 1983: 13 and Schein 1984.) The strategist's guideline applies equally to the curriculum developer, namely that the ideal image emerging from a macro-analysis of the environment cannot form the basis of training strategy (Brown 1979: 11). The culture of the organization has a limiting and prescriptive effect on the operationalization of environmental data - in other words, the culture influences the extent and way in which external and internal environmental factors can be accommodated in terms of organizational practises. The following diagram, an adaption of a model constructed by Argyris (1977), depicts this relationship.*

---

* See in this regard Chris Argyris (1977: 115) where he explains the so-called espoused theory and the importance of action theory for decision making in the context of the organizational culture.

FIGURE 7


External environment
Factors
("hard" data)
economical
technological
demographical
Internal environment
Factors
("soft" data)
social
political
life-style
Collected data
Organization
Management
Collected data
CULTURE
CULTURE
reduction of information
CONGRUENCE
STRATEGY
STRATEGY
CONGRUENCE
interpretation and strategy
training
curriculation

The data in Figure 7 are not self-explanatory, however. Management has to render them congruent with the potential and realities of the organization's infrastructure, its internal mobility and its culture (see Figure 6)*.

According to Figure 6 strategy development is a procedure and training and curriculum development an operational means for refining the WHAT of the environmental analysis to the HOW of strategy design. Figure 7 shows how data from the external environment are fed through to management, which first of all classifies it into factors that are either relevant or critical to the organization. This condensed information is then passed on to training management, along with relevant data on the organization's culture.

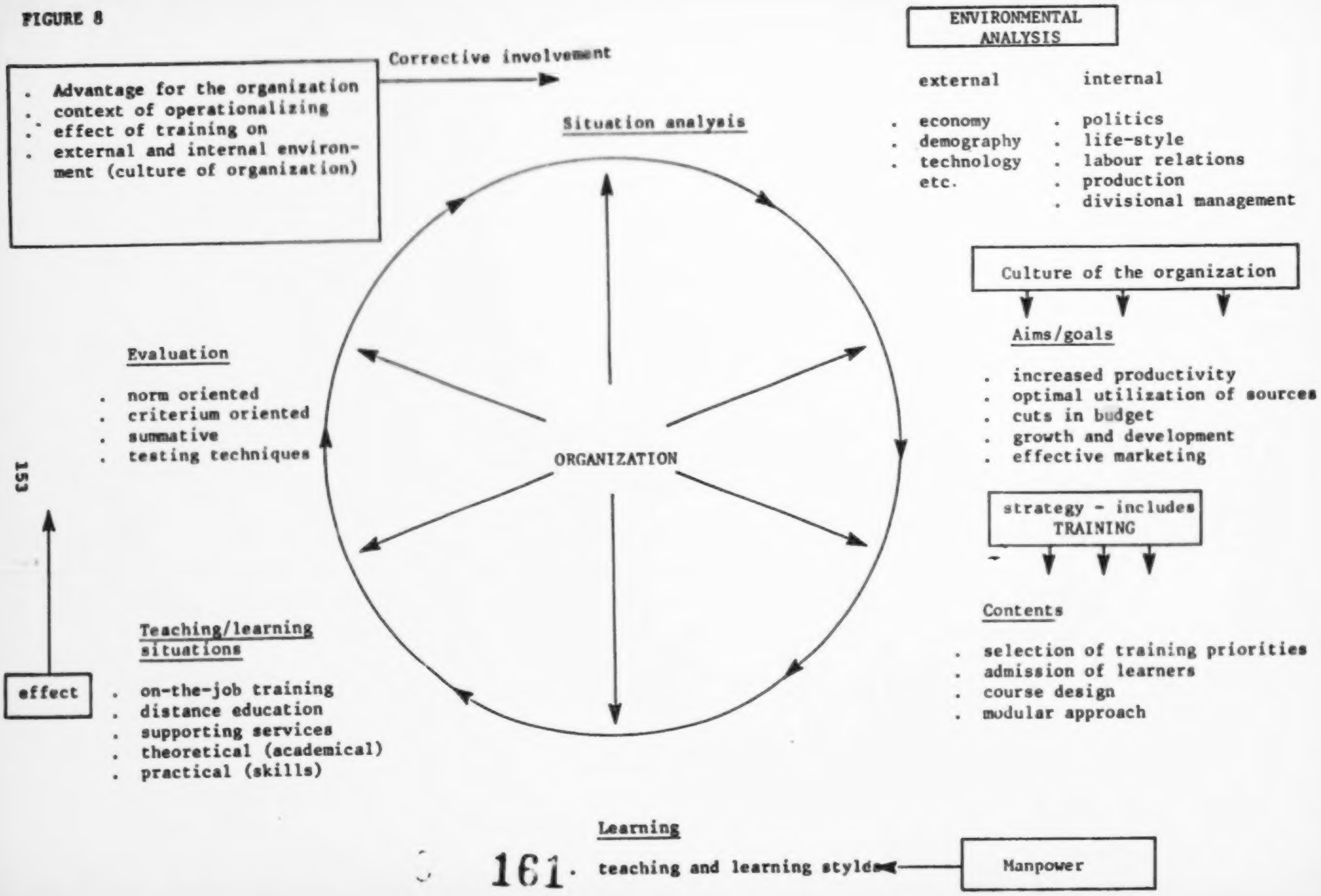
Hence when the curriculum developer proceeds on the basis of data from an environmental analysis, he must realize that his activities (goal formulation, selection of subject matter, course design/skills and competencies, evaluation and control) in actual fact optimalize strategy, in the sense that they introduce an operational slant into the process of rendering external and internal environment congruent. Here various didactic matters are pertinent, including the following:

- admission requirements and selection of learners
- readiness level of learners
- level of instruction
- pace of training programmes
- sequence
- grading of certificates
- setting of norms and standards

---

* This model was developed during a discussion with the author by Armand Kruger, former Manager, Human Resources, NPI.

FIGURE 8


. Advantage for the organization
. context of operationalizing
. effect of training on
. external and internal environment (culture of organization)
Corrective involvement
Situation analysis
ENVIRONMENTAL ANALYSIS
external
internal
. economy
. demography
. technology
etc.
. politics
. life-style
. labour relations
. production
. divisional management
Culture of the organization
Aims/goals
. increased productivity
. optimal utilization of sources
. cuts in budget
. growth and development
. effective marketing
strategy - includes TRAINING
Contents
. selection of training priorities
. admission of learners
. course design
. modular approach
ORGANIZATION
Evaluation
. norm oriented
. criterium oriented
. summative
. testing techniques
Teaching/learning situations
. on-the-job training
. distance education
. supporting services
. theoretical (academical)
. practical (skills)
effect
Learning
. teaching and learning styles
Manpower

If one considers the curriculation strategy adopted in the formal education sector (Aguilar 1967: 11), the importance for curriculum developers of the inputs from environmental analysis are manifest.

CONCLUSION

The factors on which the analysis in this paper is based are not normally identified in the ordinary course of curriculum research and development. The premise here is that the environment, organizational culture, job analysis and need assessment are factors exercising a direct, demonstrable influence on the origin, implementation and evaluation of training programmes in the non-formal educational sector. From this it appears that the interrelatedness and interaction between these factors underscore their role in programme development in training situations. As essences of programme development they emerge as a structure-in-function.

Anyone in charge of the development of training programmes in the non-formal educational sector should therefore allow for the influence of these factors when designing curricula and programmes.

REFERENCES

AGRYRIS, C. The CEO's behavior. *Harvard Business Review* 51(2), March/April 1973 : 55.

ARGYRIS, C. Double loop learning in the organization. *Harvard Business Review* 55(5), September/October 1977 : 115.

BATES, C.S. Mapping the environment: an operational environmental analysis model. *Long Range Planning* 18(5), 1985 : 97-107.

BETTIL, L.R. *Encyclopedia of Professional Management*. New York : McGraw-Hill, 1978.

BLOOM, B.S. *Taxonomy of educational objectives: the classification of educational goals*. *Handbook II*. *Affective domain*. London : Longmans, Green, 1964.

BROWN, J.K. *This business of issues: coping with the company's environments*. New York : Conference Board, 1979.

- The quality of textbooks has deteriorated and the content offers little challenge to pupils.

- American pupils devote considerably less time to academic pursuits than pupils in other industrialised countries.

In the Republic of South Africa the HSRC Investigation into Education conducted under the chairmanship of Prof. J.P. de Lange in 1980/1981 is widely known. Although the primary aim of this investigation was the establishment of principles for the provision of education rather than the monitoring of standards, the resultant White Paper on the Provision of Education in the RSA (1983) contains several comments on educational standards that have subsequently been embodied in legislation.

Thus the National Policy for General Education Affairs Act (Act 76 of 1984) stipulates that the minister of the department charged with general education affairs may lay down general policy for formal, informal and non-formal education in the Republic in respect of, *inter alia*,

- norms and standards for the financing of education for all population groups, and

- norms and standards for curricula, examinations and the certification of qualifications.

On similar lines the South African Certification Council Act (Act 85 of 1986) provides for the institution of a special body to exercise control over the standards of subject matter and examinations, as well as the issue of certificates.

2. MONITORING OF EDUCATIONAL STANDARDS

2.1 WHY MONITOR?

Livingstone (1985: 4787-4788) maintains that the principal aim of most attempts at monitoring standards is to evaluate the "products" of an

163

education system with a view to introducing measures to improve the system if its products fail to come up to expectations.

In *developing* countries monitoring of educational standards appears to be important for the following reasons:

- Information about learning results are necessary to evaluate the effectiveness of various national development programmes.

- Objective data on learning results are required by curriculum developers.

- In view of the insistence on equal educational opportunities for all citizens, central government has to obtain information on such matters as learning results in different parts of the country, possible differences between the learning results of different ethnic groups, and the relation thereof to provision of education.

- Data on learning results are also sometimes needed to evaluate the impact of a new language medium policy in schools.

Developed countries may have different considerations, for instance the following:

- Education authorities in decentralized systems are often called to account by tax-payers.

- In the recent past external examinations were replaced by internal examinations in certain countries. As a result the inspector's controlling function has changed to an advisory function. Changes of this nature often give rise to demands for more objective ways of assessing learning results.

- Curriculum innovation has caused teachers to insist on concrete evidence to justify the changes introduced.

- Provision of education to minority groups (e.g. immigrants) can be planned on the basis of assessment data.

- The development of evaluation instruments to monitor standards often leads to the publication of item banks and other media which are useful to local education authorities and teachers. Teachers involved in monitoring programmes moreover receive in-service training in evaluation.

In the Republic of South Africa the monitoring of educational standards is highly topical at present in view of central government's policy regarding the provision of equal educational opportunities for all citizens. In the first place, it is extremely difficult to compare standards in a decentralized education system. Secondly, it is feared that existing standards may be lowered in the process of providing equal educational opportunities, particularly if such provision entailed a reduction in *per capita* expenditure in certain cases in order to increase *per capita* expenditure in other cases.

In addition there is the alarming phenomenon that ever greater numbers of pupils qualify for university entrance every year while the failure rate, particularly among first-year students, remains high (Stoker et al. 1985).

2.2 WHAT IS MONITORED?

Resnick and Resnick (1983: 178) define educational standards as the result of an interaction between the requirements set for learners and the learning opportunities created for them. According to these authors three main factors influence educational standards in the USA:

- the substance taught (the curriculum)

- assessment of learning results (test and examinations)

- grouping and tracking of learners

These three key areas therefore have to be evaluated with a view to determining and raising educational standards.

According to Goertz (1986: 3-6) states and school districts set three types of standards:

- achievement standards measured by tests, examinations and other forms of assessment
- programme standards, which include curriculum standards and logistical provision
- behavioural standards, including such matters as school attendance and discipline

Coombs (1985: 113) distinguishes five internal factors in schools which affect the quality, relevance and effectiveness of education. These are objectives, curriculum, teachers, teaching media and educational technology.

One observes that all the authors cited above regard the curriculum as a key factor in determining and raising educational standards, from the national level to that of the individual school. Torrance (1986: 42) concludes: "To improve schools we need to build dialogue about *curriculum*".

With regard to the monitoring of educational standards, Livingstone (1985: 4788) concurs that the accent at present is on *curricula*. He makes the following useful distinction:

- the intended curriculum prescribed by the education authorities
- the implemented curriculum taught by teachers
- the achieved curriculum attested by learning results as measured by some evaluation instrument

2.3 HOW ARE EDUCATIONAL STANDARDS MONITORED?

Various models for the monitoring of educational standards have been designed and tested. According to Livingstone (1985: 4789) the process basically entails the following: Committees comprising teachers, curriculum experts, employers and other interested parties draw up a list of skills, insights and attitudes which in their view represent the minimum level of proficiency required for effective functioning in society and in the labour situation. On the basis of this list tests and other evaluation media are developed to determine how many pupils comply with these minimum requirements. Ideally the results are fed back into the education system in order to permit necessary adjustments to be made.

2.4 LIMITATIONS AND PROBLEMS

Livingstone (1985: 4791) identifies the following limitations and problems with regard to the monitoring of educational standards:

2.4.1 Resources

Monitoring programmes could require considerable time, money and manpower, especially when they entail testing on a national level.

2.4.2 Scope of evaluation

Critics have argued that monitoring programmes concentrate on the evaluation of a few readily measurable basic skills and ignore other learning results (e.g. creative writing skills) which, although more difficult to measure, are no less important. It is also possible in the case of decentralized education systems that some of the items included in national test programmes may be less relevant to certain groups than to others. This could affect the validity of the findings.

2.4.3 Usefulness

In practice the results of monitoring programmes are rarely applied on any scale for curriculum development, allocation of resources or the determination of priorities in educational reform. Consequently critics are asking whether the advantages of such programmes warrant the cost. The dissemination of the findings of monitoring programmes to the public at large is also receiving attention in some countries.

2.4.4 Causes of declining standards

It is of little value to monitor standards year by year unless some attempt is made to determine the underlying causes of observed changes. This would imply a proper programme of experimental, practical research with a view to passing on the findings to teachers to enable them to improve their teaching. It is argued that the amount of money spent on national monitoring programmes could be spent more productively on action research programmes in the classroom in order to improve teaching standards.

3. DEFINING THE PROBLEM

Reference was made to the institution of the South African Certification Council which exercises control over norms and standards for subject matter, examinations and the issue of certificates (see Section 1).

In the general discussion so far it was pointed out that the current emphasis in monitoring educational standards is on the *curriculum*, and a distinction was made between the intended, the implemented and the achieved curriculum (see 2.2).

It seems that the function of the Certification Council relates mainly to the intended (prescribed) curriculum and the achieved curriculum (examinations and certification). Because of the close connection between subject matter and examinations, monitoring of examination standards is often considered to be an adequate check on educational standards. There are various models for the monitoring of examination standards, which usually entails the following:

- comparison of the examination standards of various examining bodies for every subject or course

- comparison of marks obtained in the same subject in successive years

- comparison of standards for different subjects

Since all these monitoring procedures are purely comparative, one must ask how a *norm* can be established. The following illustration clarifies the point. There are various statistical techniques for rendering results obtained in Subject A comparable with those obtained in Subject B in order to assess the standard of achievement in these subjects. However, this does not tell one whether the achievement satisfies the generally accepted norm set by, for example, employers. It may for instance, be found that although achievement in two languages are of a similar standard, employers complain that new employees do not comply with the norm of effective spoken communication in one of the languages.

4. PURPOSE OF THIS DOCUMENT

Since the South African Certification Council has the task of controlling norms and standards not only for examinations but also for subject matter, it is necessary to consider

- how to interpret the concept of *norms and standards for subject matter and examinations*, and

- how to devise strategies for determining norms and standards for *subject matter*.

Although the accent in this document is on *subject matter,* the latter cannot be divorced from examinations when it comes to monitoring educational standards. Consequently both aspects will be dealt with.

5. NORMS AND STANDARDS FOR SUBJECT MATTER

Pretorius (1985) maintains that norms for subject matter refer to premises or criteria applied in compiling syllabi. Several attempts have been made to establish such criteria, including the following:

- Hass (1980: 7) regards the *aims and objectives* of a curriculum as the main criteria for evaluating it.

- Several authors consider the *learner* to be the key criterion for the selection and arrangement of curriculum content (De Vaal, Van den Berg 1977; Hass 1980; Hill 1975; Pauw 1977; Van Til 1980; Work Committee: Curriculum Development 1981). Pertinent factors include the learner's level of development, his learning readiness, the nature of his knowledge and cognition and his freedom of choice.

- Other major criteria are the needs, values and life-view prevailing in a *society* (Hass 1980: 6-7; Pauw 1977: 73-74; Van Til 1980: 375).

- *Subject matter* is obviously an important criterion when compiling a curriculum. Relevant considerations include the following:

- the peculiar nature of the subject (De Vaal, Van den Berg 1977: 102; Hill 1975: 242)

- the amount of subject matter (De Vaal, Van den Berg 1977: 24) and the period within which the course has to be completed

- meaningfulness of subject matter to both teacher and pupil (Hill 1975: 241)

- positive content of subject matter (Hill 1975: 242)

- how representative it is of the total body of knowledge (Hill 1975: 242)

- optimal potential for specialization (Hill 1975: 244-245)

- formative potential of subject matter (Hill 1975: 245)

- balance (Hass 1980: 7)

- flexibility (Hass 1980: 7)

- relevance (Hass 1980: 7)

- arrangement of subject matter in a macrocontext: arrangement of subjects in particular years, grouping of subjects in subject packages/phases/courses, relation to content of other courses (Work Committee: Curriculum Development 1981: 102)

* Various *didactic considerations* are also considered to be important criteria for curricula:

- differentiation (De Vaal, Van den Berg 1977: 29; Hass 1980: 7; Work Committee: Curriculum Development 1981: 48-49)

- mastery and sound didactic treatment of subject matter by teacher (Hill 1975: 241-242)

- logistic provision (Work Committee: Curriculum Development 1981: 51)

- nature and function of the educational or training institution (Pauw 1977: 72).

The General Certificate of Secondary Education (GCSE), which is to be examined in England and Wales as from 1988, is a good example of the application of criteria in curriculum development. The various examining bodies (and even individual schools) are permitted to develop their own curricula within the framework of certain prescribed criteria. In addition to assessment criteria, rules for assessment procedures and criteria for the award of specific grades, the objectives for subject curricula and criteria for the selection and organization of subject matter are spelled out in the "National Criteria" (1985), from which we quote the objectives for English as a subject:

"The course should seek to develop the ability of students to:

1.1.1 communicate accurately, appropriately and effectively in speech and writing;

1.1.2 understand and respond imaginatively to what they hear, read and experience in a variety of media;

1.1.3 enjoy and appreciate the reading of literature;

1.1.4 understand themselves and others."

In order to evaluate the extent to which learners have achieved these objectives, the following criteria are laid down for the formulation of assessment objectives:

"2.1 The Assessment Objectives in a syllabus with the title English must provide opportunities for candidates to demonstrate their ability to:

2.1.1 understand and convey information;

2.1.2 understand, order and present facts, ideas and opinions;

2.1.3 evaluate information in reading material and in other media, and select what is relevant to specific purposes;

2.1.4 articulate experience and express what is felt and what is imagined;

2.1.5 recognize implicit meaning and attitudes;

2.1.6 show a sense of audience and an awareness of style in both formal and informal situations;

2.1.7 exercise control of appropriate grammatical structures, conventions of paragraphing, sentence structure, punctuation and spelling in their writing;

2.1.8 communicate effectively and appropriately in spoken English.

2.2 The skills listed above are clearly interrelated and interdependent and, whilst all must be assessed, it is not envisaged and each skill need be separately tested. These language skills must be tested with reference to both literary and non-literary material, and all except 2.1.7 and 2.1.8 are capable of being tested in both speech and writing."

The contents of curricula for English as a subject have to comply with the following criteria:

"The content of the examination syllabuses in English must provide for a range of experiences of (a) oral communication, (b) reading and (c) writing, designed to develop the skills stated in 2.1 above. This must involve sustained writing and sustained reading of various kinds, including the reading of whole works of literature rather than extracts only. Examining Groups should give guidance about recommended reading, but syllabuses must not require the study of prescribed texts.

3.1 Oral communication

Opportunities must be provided for pupils to develop the skills of oral communication in situations where individuals are both listeners and speakers as, for example, in interviews of various kinds or in group discussion. Emphasis should be placed on the interrelatedness of listening and speaking.

3.2 Reading

Opportunities must be provided for pupils to read for various purposes both literary texts (e.g. short stories, novels, autobiographies, poetry, plays) and non-literary material (e.g. newspaper articles, advertisements) and to respond in a variety of ways to what is read.

3.3 Writing

Opportunities must be provided to develop a variety of styles of writing in what may be termed 'closed' situations (e.g. the writing of letters, reports and instructions) where the subject matter, form, audience and purpose are largely 'given' and in what may be termed 'open' situations (e.g. narrative writing and imaginative/personal response to a range of stimuli and experience) where such factors are largely determined by the writer. Response to reading may include the opportunity to write factually or imaginatively in developing and exploring themes and ideas arising from what is read."

Although the above criteria afford valuable guidelines for the selection and organization of subject matter, most of them have little to do with standards. According to Pretorius (1985) standards for syllabi relate mainly to requirements for content, as regards both the subject options for courses and the nature and degree of difficulty of subject matter.

In order to monitor standards for subject matter it might be necessary to compare the content of a particular course with

- that of other subjects offered by the same education authority at that particular level

- the syllabi of, for instance, tertiary educational institutions
- syllabi for the same subject as presented by other education authorities.

In addition the overall curriculum will have to be considered. It is sometimes said that candidates who offer a particular subject package have less difficulty in gaining admission to university than those offering other packages. One would therefore have to establish whether different subject packages are all of a similar standard.

Pretorius (1985) regards core subject matter (i.e. compulsory common subject matter necessary to determine whether uniform standards are being maintained) as an important norm for subject matter.

6. NORMS AND STANDARDS FOR EXAMINATIONS

Pretorius (1985) regards norms for examinations generally as the requirements that an examination has to satisfy, including validity, reliability, being representative of the subject matter, adequate time for writing, fairness in regard to degree of difficulty, and objectivity in regard to marking and allocation of marks. In the case of norms for examinations administered by different examining bodies the question of subject matter is of cardinal importance. Subject matter modules should overlap to afford a basis for uniform examination.

According to Pretorius (1985) examination standards refer to the level maintained in an examination and relate to both the examination content and the method of marking and allocation of marks.

The Report of an Intersectoral Committee of Investigation into the Composition and Functions of a National Certifying Council (1984) deals with various models for monitoring examination standards. A few will be mentioned.

Where there is a *minimum of compulsory common subject matter* and the *assessment is norm-related, the following possibilities may be considered:*

- Every examining body is responsible for compiling and marking its own examination papers. A central panel of moderators evaluates the papers in respect of degree of difficulty and recommends adjustments to marks that are necessary to ensure equal standards.

- The examination papers of the various examining bodies should have certain questions in common. Performance of candidates in these questions is used to determine the adjustment to marks. Marks are adjusted in such a way that candidates who obtained the same mark in the common questions obtain the same adjusted overall mark.

- Instead of common questions, different item bank questions are used which cover the minimum compulsory common subject matter and which are of a comparable degree of difficulty.

- A random sample of candidates of each examining body write a separate examination paper compiled and marked by a central monitoring body such as the South African Certification Council. The performance of these candidates is used as a basis for assessing the examination standards of the various examining bodies.

- Shortly before the final examination all candidates write a standardization examination on the minimum compulsory common subject matter in every subject. Their performance in this examination is used as a basis to adjust marks in order to ensure equal standards.

Where there is *no minimum compulsory common subject matter* a scholastic test may be used to determine the necessary mark adjustment.

Minimum competency testing has been applied in various American states in recent years and there is a considerable literature on the pros and cons of such a system. Although these test programmes can help to improve education (Popham et al. 1985), several authors warn that any form of external test used to publicly compare student performance may hamper curriculum development, since teaching may be geared to a great extent to preparing pupils for the test programme (Bond 1986: 4).

An interesting alternative - unfortunately still to be tested in practice - is that of establishing achievement criteria for the allocation of specific symbols or grades such as those laid down in the National Criteria of the GCSE, in which the first examinations are to be written in England and Wales in 1988. By way of illustration the following is quoted from the National Criteria (1985) for English as a subject, specifically with reference to written work:

"GRADE F

The candidate can be expected to have demonstrated competence in:

6.3.1 understanding and coveying information at a straightforward level;

6.3.2 understanding basic facts, ideas and opinions and presenting them with a degree of coherence;

6.3.3 selecting material and commenting upon it at a literal level;

6.3.4 describing experience in concrete terms and expressing intelligibly what is felt and what is imagined;

6.3.5 recognising clear meanings and explicit attitudes;

6.3.6 showing awareness that language is used in different ways in different circumstances;

6.3.7 showing sufficient control of the written language to communicate effectively despite some weakness in spelling, punctuation and the construction of complex sentences."

In order to obtain a Grade C the candidate is expected to be skilled in respect of

"6.4.1 understanding and conveying information both at a straightforward and at a more complex level;

6.4.2 understanding facts, ideas and opinion, and ordering and presenting them with a degree of clarity and accuracy;

6.4.3 evaluating material and selecting what is relevant for specific purposes;

6.4.4 describing and reflecting upon experience and expressing effectively what is felt and what is imagined;

6.4.5 recognizing the more obvious implicit meanings and attitudes;

6.4.6 showing a sense of audience and an awareness of uses of language appropriate in different situations;

6.4.7 writing in paragraphs, using sentences of varied kinds and exercising care over punctuation and spelling."

It is envisaged that these criteria-related grades will be awarded to all candidates who have attained the required standards - hence to have purely criterion-related assessment, without any norm-related evaluation in the form of mark adjustment.

Strategies for monitoring standards between the different examining bodies, and also from year to year, should be designed under the supervision of the Secondary Examinations Council. Close attention will have to be given to monitoring standards in such an examining system, as the allocation of symbols largely depends on the evaluator's interpretation of the defined performance objectives. In such a system much scope is left for curriculum development, as a single external examination based on the minimum compulsory common learning content is not required.

7. SYNTHESIS

The system currently in use in Queensland, Australia represents a combination of the criterion- and norm-related approaches (Nuyen 1986). The Board of Secondary School Studies issues a core syllabus, on which individual schools base their work programmes. These are then accredited on the recommendation of so-called review panels. At the end of their tenth and twelfth school years pupils are subjected to criterion-related assessment of the measure in which they have attained the aims of the school's work programme. These evaluations are certified by the Board provided the review panels are satisfied that the pupils' work conforms to the aims of the subject as set out in the accredited work programme.

This criterion-related system makes it virtually impossible to achieve comparability *between different subjects*, and it is doubtful whether it can effect comparability even *within the same subject*. This is largely due to the lack of comparability between work programmes which are accredited on the strength of conformity with certain *minimum* standards and not on the basis of some measure of correspondence with the programmes of other schools.

Tertiary educational institutions, however, have a need for norm-related assessment for selection purposes. Consequently the Australian Scholastic Aptitude Test is used as a basis for scaling marks obtained at school. Teachers are expected to submit, in addition to their criterion-related assessment, a mark which may be used for this purpose. As a result one finds in practice that teachers continue to make use of norm-related assessment and then convert these marks to criterion-related grades.

This system demonstrates that as long as there is a need, for whatever reason, to have norm-related assessment to permit comparison of student performance, it is virtually impossible to have proper criterion-related assessment which allows more scope for curriculum innovation.

In the preceding sections the focus was partly on norms and standards for subject matter (the intended curriculum) and partly on norms and standards for examinations (the achieved curriculum). It should be borne in mind, however, that *teaching* (the implemented curriculum) constitutes a vital link between the other two facets of the curriculum.

Any attempt to monitor educational standards would have to take this point into account. Relevant matters in this regard include teacher training, teaching material and inspection.

Although it is possible, for the sake of conceptual clarity, to distinguish between norms and standards for subject matter and norms and standards for examinations, the two cannot be separated in practice. The quality of the subject matter and the teaching largely determines the standard of student achievement, while the nature and standard of examining can have a direct influence on both subject matter and tuition (Anrig 1985; Darling-Hammond, Wise 1985).

In view of the preceding discussion the following is proposed for further consideration:

Further research into the monitoring of educational standards should be a priority. Coombs (1985: 107) mentions that "[q]uality and standards are in fact *relative* matters - relative to the particular time and place and to particular learners and their circumstances". This point is particularly relevant to the educational situation in the Republic of South Africa where, in the midst of great disparities in respect of both learners and provision of education, an attempt has to be made to maintain equal educational standards.

When monitoring educational standards, one has to strike a balance between subject matter, teaching and examining. None of these facets should be overemphasized at the expense of the others. In addition standards should be monitored during *all* phases of schooling and not merely at specific school-leaving stages. When innovations are introduced as a result of the findings of monitoring, they should be introduced in all phases of schooling so as to ensure continuity.

As for the practical situation, there appear to be two main possibilities:

- norm-related evaluation, implying minimum compulsory common subject matter (core curricula) and some form of external examination, or

- criterion-related evaluation, which allows more scope for diversification in curriculation and examination.

In the case of the first possibility, the monitoring function of the South African Certification Council would be as follows:

- determining minimum compulsory common subject matter and issuing core curricula

- accrediting individual syllabi or work programmes based on the core curricula

- approving content of external examinations

- monitoring the administration of the examinations, marking and allocation of marks, as well as the normalization of marks.

In the case of criterion-related evaluation, the Certification Council would

- lay down criteria for the selection and organization of subject matter, on the basis of which the various educational authorities could develop their own curricula

- develop criteria for the evaluation of syllabi and apply these to accredit individual syllabi

- establish criteria for examinations and the allocation of symbols, which the various examining bodies may apply to assess pupil performance

- devise strategies for determining and maintaining examination standards

Since each of these options has its weaknesses, an attempt should be made to combine them. A report of the Scottish Education Department on evaluation in secondary education (1977: 43) sums up the matter as follows:

"Fundamentally a balance has to be struck between providing, on the one hand, curricular freedom which will encourage pupil and teacher initiative, while on the other maintaining standards of attainment, assessed by an external agency and based on a nationally agreed curriculum. Consideration is therefore required of the proportion, not only of internal/external assessments, but also of internal/external syllabuses."

REFERENCES

ANRIG, G.R. Educational standards, testing, and equity. Phi Delta Kappan 66(9), May 1985 : 623-625.

BOND, L. In defense of admissions testing. The Education Digest 52(23), November 1986 : 40-42.

COOMBS, P.H. The world crisis in education. The view from the eighties. New York : Oxford University Press, 1985.

DARLING-HAMMOND, Linda., WISE, A.E. Beyond standardisation: State standards and school improvement. The Elementary School Journal 85(3), January 1985 : 315-336.

DEPARTMENT OF EDUCATION AND SCIENCE WELSH OFFICE. General Certificate of Secondary Education. The National Criteria. English. London : Her Majesty's Stationery Office, 1985.

DEPARTEMENT VAN NASIONALE OPVOEDING. Verslag van 'n intersektorale komitee van ondersoek na die samestelling en funksies van 'n nasionale sertifiseringsraad. Pretoria : Departement van Nasionale Opvoeding, 1984.

DE VAAL, D.J., VAN DEN BERG, D.J. Die ontwerp en toepassing van kriteria vir die samestelling van gedifferensieerde Wiskundesillabusse. Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1977.

GOERTZ, Margaret E. State educational standards: A 50-state survey. New Jersey, Princeton: Educational Testing Service, 1986.

HASS, G. Curriculum planning. A new approach. Boston : Allyn and Bacon, 1980.

HILL, J.S. Kriteria vir die seleksie en ordening van kurrikuluminhoud. Pedagogiekstudies nr. 85. Pretoria : Universiteit van Pretoria, 1975.

LAPOINTE, A.E., KOFFLER, S.L. Your standards or mine? Educational Researcher 11(10), December 1982 : 4-9.

LIVINGSTONE, I.D. Standards, National: Monitoring. The International Encyclopedia of Education. Oxford : Pergamon Press, 1985.

NATIONAL COMMISSION ON EXCELLENCE IN EDUCATION. A nation at risk: The imperative for educational reform. American Education 19(5), June 1983 : 2-17.

NUYEN, N.A. Equating achievement across subjects: is it possible? The Queensland experience. Studies in Educational Evaluation 12(3), 1986 : 245-250.

PAUW, J.R. Designing a curriculum in higher education. South African Journal of Pedagogy 11(2), September 1977 : 70-86.

POPHAM, W.J., et al. Measurement-driven instruction: It's on the road. Phi Delta Kappan 66(9), May 1985 : 628-634.

PRETORIUS, D.J. Norme en standaarde met betrekking tot sillabusse en eksamens (konsepverslag). Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1985.

RAAD VIR GEESTESWETENSKAPLIKE NAVORSING. Ondersoek na die Onderwys. Verslag van die Werkkomitee: Kurrikulering. Pretoria, 1981.

RESNICK, D.P., RESNICK, Lauren B. Improving educational standards in American schools. Phi Delta Kappan 65(3), November 1983 : 178-180.

SCOTTISH EDUCATION DEPARTMENT. Assessment for all. Report of the committee to review assessment in the third and fourth years of secondary education in Scotland. Edinburgh : Her Majesty's Stationery Office, 1977.

STOKER, D.J., ENGELBRECHT, C.S. et al. Ondersoek na die differensiële toelatingsvereistes tot tersiêreonderwysinrigtings. Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1985.

SUID-AFRIKA (Republiek). Witskrif oor onderwysvoorsiening in die Republiek van Suid-Afrika. Pretoria : Staatsdrukker, 1983.

TORRANCE, H. What can examinations contribute to school evaluation? Educational Review 38(1), 1986 : 31-43.

VAN TIL, W. What should be the content of curriculum? The Educational Forum 44, March 1980 : 375-376.

APPROACHES TO LEARNING TO READ WITH A VIEW TO DESIGNING AN INITIAL AND REMEDIAL READING PROGRAMME

A. DEDNAM

1. INTRODUCTION

Reading requires two simultaneous reading acts from the reader, namely the recognition of words - implying the decoding of graphical symbols into sounds - and the comprehension of the text content. For teaching reading in the primary classes, some teachers make predominant use of the analytical approach in terms of which particular attention is devoted to the identification of words, while others follow the whole-word approach which emphasizes reading comprehension. A third group stresses the combined or eclectic approach which gives equal prominence to the identification of words and reading comprehension. Regardless of the approach there are still pupils who are not succeeding in learning to read. The challenge is to find an approach which will ensure success for the pupil with reading problems.

2. THE ANALYTICAL APPROACH

The analytical approach concentrates mainly on decoding exercises during which the correspondence between graphemes and phonemes serves as the point of departure. An inductive method is used since the pupil initially learns the word elements and synthesizes them gradually into word units and subsequently into sentences. Protagonists of this approach assume that the pupil understands what he reads while he synthesizes and pronounces the words (Aukerman 1984 : 11). Although the advantages of this approach cannot be denied, there are also those who strongly oppose the approach, particularly for the following reasons (cf. Greyling and Joubert s.a. : 61-62; Aukerman 1984 : 11 and Dumont 1976 : 172):

- Reading for comprehension is hampered since the pupils are forced to concentrate on the letter detail of each word. The analytical approach inculcates a mechanical method of reading in the pupil and pays scant attention to reading comprehension.

- Reading tempo is seriously retarded because the pupils concentrate on each letter of a word.

- The eye-span is limited because the pupils fixate and concentrate on small units in words. Only after one part of a word has been read, can the next be tackled.

- The correspondence between graphemes and phonemes which the pupils learn initially, has no significance for the pupils and some of them consequently lose interest in reading.

- There is no natural flowing style of reading since each word is decoded separately and then read.

- Pupils become overdependent on this procedure since they know no other method of grasping words which cannot be analysed purely phonetically.

- The text that is used is generally oversimplified to provide for easy words.

- The language level of the text is lower than the pupils' level of speech.

- The visual and auditive learning skills of the pupil are overemphasized.

- It is also maintained that pupils who learn to read by means of the phonetic approach do not necessarily spell better than those who have been taught by the whole-word approach.

3. THE WHOLE-WORD APPROACH

This approach is mainly of a deductive nature since the pupil first learns the sentence and word units and then by degrees the elements in the sentences and words. In this regard Aukerman (1984 : 317) states:

"A whole-word approach to beginning reading provides materials containing whole words and simple sentences for children to read prior to learning the nitty-gritty 'skills' such as phonics, syllabication, rules, and so on." The advocates of this approach consider it important that the pupil should understand the content from the outset. He/she finds the reading matter interesting and consequently develops the will to read. The protagonists of this approach assume that the pupil begins to perceive the word elements as a matter of course as he obtains more practice in reading and learns to know the words better.

Although Greyling and Joubert (s.a. : 61-62) acknowledge the advantages of the whole-word approach, they have among others the following reservations:

- The spelling ability of a group of pupils is poor because they have not been taught to detect letter detail.
- The pupils often experience problems in reading new words and words with strange spelling structures, because they cannot analyse these words and synthesize the word elements afterwards.
- The pupils often anticipate words with the result that they commit errors as a result of incorrect anticipation.

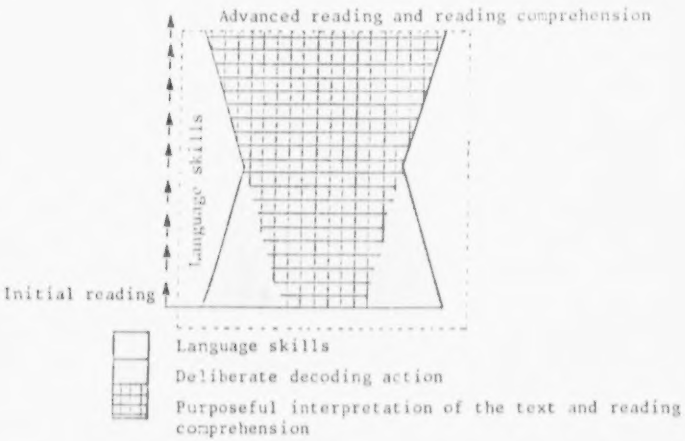
4. DISCUSSION

In order to arrive at a decision on the desirability of the use of the analytical, whole-word or a combined or eclectic approach for a beginning and remedial reading programme, it is firstly necessary to determine how a child learns to read and what role is played by the recognition of words and reading comprehension in the case of the beginner and the poor reader.

4.1 LEARNING TO READ

The following model serves as an illustration of the way in which the reading components, namely recognition of words and reading comprehension, interact when the pupil learns to read.

LEARNING TO READ


Advanced reading and reading comprehension
Language skills
Initial reading
Language skills
Deliberate decoding action
Purposeful interpretation of the text and reading comprehension

Since the written language symbolizes the spoken language the reading act is a language usage act. A particular level of language proficiency is consequently a prerequisite for the ability to read. The mastery of language is the basis on which both components of reading rest.

However, language proficiency is more than merely the basis of reading. It goes much further. Development of language proficiency commences during the first two years of a child's existence. When he starts to read his ability to use language has developed to such an extent that the reading act is supported by this. As his reading ability grows, his language proficiency develops at the same time and he is able to communicate at an increasingly higher level and to understand what he reads. This development does not cease when he has reached a particular stage but continues as he grows older.

When a child begins to read, the graphical symbols and the way in which they are arranged, are initially strange to him. Decoding and the recognition of words are consequently still deliberate acts to which the pupil devotes more attention than to reading comprehension. As the act of decoding and the recognition of words become more automatized, he starts reading with the deliberate purpose of understanding the content of the text. He no longer learns to read but now reads to learn. Although the recognition of words no longer occurs deliberately, it still plays a role whenever the child reads, since words must always first be recognized to understand their content (see Goodman 1984 : 101-107; Reitsma 1984 : 422; Perfetti 1984 : 38).

4.2 THE ROLE PLAYED BY THE RECOGNITION OF WORDS AND READING COMPREHENSION IN THE INITIAL AND POOR READER

According to Dumont (1976 : 160) children of approximately five/six years generally observe objects in their totality. The same is true of older pupils with reading problems, since they are inclined to use infantile learning patterns which correspond with those of younger children. They perceive the words and parts of words as units and are less aware of the detail in the words.

As a result of objections to the analytical approach, there are educationists who concentrate mainly on the whole-word approach in which reading comprehension is emphasized. Southgate, Arnold and Johnson (1981 : 30) state that when a pupil reads, he should be able to recognize 95 % of the words in the text immediately. Unknown words are recognised by means of contextual clues and syntactical-grammatical inferences.

Protagonists of the whole-word approach concentrate mainly on the global perception skills of the pupils and expect pupils to learn to read words as a whole and not to concentrate on word and letter detail. The abovementioned authors assume that the pupil will gradually become more acquainted with internal detail as he learns the words more effectively in their totality. He consequently becomes naturally aware of the grapheme-phoneme correspondence in words.

The teachers who use purely whole-word methods also assume that there is no logical connection between the speech sound and the letters of the alphabet. The Western writing system consists of the twenty-six letters of the alphabet which in view of the many sound nuances of the spoken language are in themselves inadequate. Posthumus (1972 : 148) identified seventy-five sound nuances in spoken Afrikaans. On these grounds the whole-word approach appears to be the most suitable for teaching pupils to read and for facilitating remediation.

It is however a fact that there are pupils who do not learn to read effectively through the whole-word approach. This method was generally used for initial reading in schools in the RSA in the fifties. Since there were still pupils who experienced difficulty in reading a new approach was sought. Greyling and Joubert (s.a. : 88-89) point out that there is no best or single, generally valid approach to reading instruction even if circumstances were the same in all cases. The same approach does not ensure the same satisfactory results in all schools and classes. Each approach contains something valuable and success can be achieved with each approach.

Since each pupil learns to read in a unique manner, exclusive dependence on the whole-word approach is not always successful in the beginners' classes nor in the case of pupils with reading problems. With this in mind an attempt is made to reconcile the two abovementioned learning-reading approaches by means of a combined or eclectic approach. The analytical approach rectifies shortcomings in the whole-word approach and vice versa. Aspects of the one approach, which pose problems for the pupil can be solved by the other. This gives rise to the question as to the extent to which the pupil does in fact make use of word recognition, reading comprehension and word detail when he learns to read. In order to answer this question, the degree in which pupils perceive letter detail and the reading approaches which appear to be most suitable for beginning and remedial reading, will subsequently be examined.

Otto (1982 : 18) asks the following questions with regard to word recognition and reading comprehension: "Do readers become more proficient because they learn to see the letters better, or because they learn to integrate phonetic, grammatical, semantic and background information better to create meaning? Does the reader's idea of the meaning on the page affect his/her perception of words and letters?" To find answers concerning the abovementioned reading acts the findings of certain researchers will subsequently be examined.

Goodman (1984 : 101) has the following to say about reading: "Comprehension, at some level, is always the end product of any act of reading. During the reading the reader is engaged in comprehending, that is, trying to make sense of the text. This distinction between comprehending as process and comprehension as product is important and useful." He adds (ibid. : 102): "Effective comprehending is essential to effective comprehension but not sufficient."

In order to make sense of the text the reader must, according to Goodman (1984 : 107), master three systems, namely the grapheme-phoneme system, the syntactical and the semantic system. The author (ibid.) maintains that reading is in effect a cyclical psycholinguistic activity of the grapheme-phoneme, the syntactical and semantic systems. The grapheme-phoneme system implies the optical awareness and the perceptual observation that determine the quality of the reader's realization of the syntactical structures in the text, whereas knowledge of the syntactical structures is the basis of the semantic aspect of the text. The syntactical system consists of the symbolic word units that have meaning and the semantic system implies the complex social and personal information in the text. One aspect of the semantic system is pragmatism, of which humour and sarcasm, among other things, are part. Goodman (ibid.) says of this cyclic function: "... it is a sequence like a merry-go-round in which an optical cycle follows a semantic cycle as well as preceding it." According to the abovementioned author (ibid.) the cyclic succession of the three systems has reading comprehension as its aim. The cycle does not always proceed step by step but the steps can flow into one another gradually. Comprehension is consequently possible without necessarily completing the optical, syntactical and semantic cycles. The skilful reader no longer carries out each decoding act deliberately since he is able in an automatized (internalized) manner to incorporate all three systems at a glance and derive meaning from the text.

Reitsma (1984 : 422) came to the conclusion that the written symbols must be decoded into sounds before they can be accorded meaning. He declares that if a pupil recognizes a word at sight it cannot be proved that the word was read purely visually and that no grapheme-phoneme analysis has taken place. The abovementioned author believes that there is a possibility that the reader analyses the graphemes in a word on the strength of his knowledge of the order of the letters in words that are familiar to him since the better he reads, the more effective and accurate will be phonemic representations of grapheme groups. Reitsma (*ibid*.) also concludes that it takes some years before a pupil is really able to recognize a word merely at sight without any form of deliberate decoding. Considerable attention should consequently also be devoted to decoding before it can be assumed that the pupil is able to read words at sight without assistance. According to Reitsma, adequate achievement in reading depends on *increasing efficiency* in grapheme-phoneme decoding and knowledge of the orthographic structures.

Perfetti (1984 : 35) also feels that the reader must master orthography before being able to read. As the pupil gains more practice in decoding, the act becomes more automatized and less deliberate attention is required. Perfetti is of the opinion, however, that word recognition need not be practised separately but that it should form part of the *integrated reading instruction programme*. According to the abovementioned author (*ibid*. : 36-37) pupils with reading problems are dependent on contextual clues when they read. The importance of decoding during the reading act is emphasized but the author points out that the level of word recognition depends to a greater extent on the quality of the pupil's linguistic skills than on his visual skills. Reading comprehension is consequently limited by shortcomings in the basic language skills, such as a limited vocabulary. The writer also acknowledges that inadequate recognition of symbols - as a visual and not a language skill - can also be part of the reading problem.

Fitzgerald and Spiegel (1983 : 15) found that pupils read words arranged in the form of a story much more readily than the same words in unstructured form. The authors consequently recommend that contextual aspects should form a continuous part of the method of reading instruction.

Blaxall and Willows (1984 : 339) concluded from their research that pupils read better when they utilised contextual clues. They also state (ibid.) that it is in fact the poor readers who are inclined to depend on contextual clues when they attempt to read difficult words while the good readers change their strategy and try to decode the words.

Morrison (1984 : 23-25) did not find any difference between the ability of good and poor readers to form associations. The above-mentioned author (ibid. : 23) did however arrive at the conclusion that poor readers experience greater problems than ordinary readers as regards associations based on the rules of spelling. Pupils with reading problems had less difficulty in reading words which complied with consistent spelling rules, as well as words with spelling rules that apply consistently in specific cases, than words in which there were inconsistencies in respect of the rules. The good readers also found it more difficult to read low frequency words with inconsistent spelling rules. It would therefore appear that poor readers, just like good ones, are inclined to try and decode a strange word when they have to read it. The pupils even use auditive closure in their attempts to recognize strange words.

Stanovich, Cunningham and Feeman (1984 : 668-675) state that poor readers will necessarily depend to a greater extent on contextual clues to identify words if they have effective insight into the text.

Stanovich (1984 : 15) explains reading on the stren interdependent-compensatory model in which pupils rely on the skill to compensate for the other skill which poses problems. The method used to teach reading consequently depends on the individual pupil.

Vellutino and Scanlon (1984 : 40) also maintain that pupils with reading problems find it difficult to understand and learn the grapheme-phoneme correspondences. However, they state that this problem need not necessarily be ascribed to factors directly related to reading problems but can, among other things, be caused by cognitive and/or language problems. The abovementioned authors (ibid. : 42-43) support Stanovich's interdependent-compensatory model since there are continuous supplementary acts when a person is engaged in processing information. This point of view is based on the following:

- Stanovich's model emphasizes the interactive role of a variety of factors when a person processes information.

- The compensatory role of the various skills enhances the power of the interactive acts during word recognition.

- The model offers a framework within which individual differences in respect of reading can be studied.

- Poor readers rely to a greater extent on reading comprehension to identify words whereas the good reader can decode words with ease.

- The compensatory aspect of this model applies in particular to the average and poorer readers because of the unique manner in which each reader performs the word recognition actions.

Briggs, Austin and Underwood (1984 : 60-61) also support Stanovich's interdependent-compensatory model. Although these authors found little difference in the quality of the perceptual skills in the poor and good readers they came to the conclusion that poor readers experience more problems than the good ones in decoding words. The word recognition problems of the poor reader cannot therefore be attributed simply to a possible deficiency in perceptual skills. It is assumed however that poor readers rely on as many skills as possible and also on contextual clues to compensate for their decoding problem.

Oney and Goldman (1984 : 557-568) studied the relationship between decoding and reading comprehension by comparing the Turkish orthographic system, which is mainly of a phonetic nature, with that of English where the grapheme-phoneme correspondence is not so strong. (Since Afrikaans orthography, as in the case of Turkish, is generally phonetic, the results of this research may possibly have significance for an analysis of the methods of learning-reading in Afrikaans.) According to the abovementioned authors, pupils on the first school level who learn to read by means of a phonetic-orthographic system fare better than those using the whole-word approach since the former group can recognize all the words by decoding them whereas the latter are unable to identify all the words. Oney and Goldman (1984 : 566) state : "When there are high degrees of regularity in letter sound correspondences, decoding proceeds quickly at high levels of accuracy. Individual word decoding thus appears to be an efficient route to meaning for languages such as Turkish." However, the authors recommend that unknown words should be learned in their context and not only by means of decoding since the contextual relationships pave the way for the recognition of word elements.

5. SUMMARY

According to Fitzgerald and Spiegel (1983 : 101), Blaxall and Willows (1984 : 339) and Vellutino and Scanlon (1984 : 40) the utilization of the contextual clues is of prime importance when pupils learn to read since these clues help them to recognize words as a whole and comprehend the written content. According to these authors the whole-word approach is apparently the most suitable one to use. However, since all pupils do not learn to read by means of this method it is essential to determine the extent to which the analytical and/or eclectic approach should be employed in reading instruction.

Stanovich, Cunningham and Feeman (1984 : 668-675) maintain that poor readers will necessarily rely to a greater extent on contextual clues to identify words if they have complete insight into the text. In order to enable the pupil to understand strange words that cannot be inferred from the context he must be assisted to decode words with the aid of an analytical model.

Goodman (1984 : 101-107) and Oney and Goldman (1984 : 557-568) are of the opinion that both reading acts, namely word recognition and reading comprehension function when a person reads adequately since pupils tend to decode strange words that cannot be inferred from contextual clues in order to read them. Perfetti (1984 : 36-37) also feels that the two reading acts play a part in reading and states that words must first be decoded, albeit not necessarily deliberately, before a part of a text can be read and consequently understood. Briggs, Austin and Underwood (1984 : 60-61) assume that the poor reader relies on as many abilities as possible and also on contextual clues to compensate for his decoding problem. Stanovich's (1984 : 15) interdependent-compensatory model can consequently be used as the point of departure for the selection of a specific reading instruction method in respect of a particular pupil. Since a pupil relies more heavily on one skill to compensate for the skill with which problems are experienced, the teacher must decide on the approach that should be followed to teach the pupil to read.

It is obvious from the foregoing discussion that reading comprehension and word recognition function simultaneously when the pupil reads. The decoding of words, recognition of words or known parts of words as a whole and the use of contextual clues to recognise strange words or unknown parts of words as a whole, enable the pupil to read adequately. The one approach can consequently not be regarded as inferior to the other and all aspects of both approaches must be utilised to provide for the specific needs of the particular pupil.

Since all pupils make use to a greater or lesser extent of decoding of whole-word recognition and of contextual clues when they read, the following conclusions can be made with regard to an initial and remedial reading programme. *Simultaneous use should be made of the decoding act, whole-word recognition and contextual clues when pupils are instructed in reading*. It would thus appear that the eclectic approach should be appropriate for an initial and remedial reading programme since it provides for decoding exercises, whole-word recognition and for reading comprehension. The selection of the reading methods to be employed depends to a large extent on the unique manner in which each pupil learns. It is therefore essential that the teacher be aware of the pupil's deficiencies, skills and reading preferences when he teaches the pupils to read.

REFERENCES

AUKERMAN, R.C. *Approaches to beginning reading*. Second edition. New York : John Wiley & Sons 1984.

BLAXALL, J., WILLOWS, D.M. Reading ability and text difficulty as influences on second graders' oral errors. *Journal of educational psychology* 76(1), 1984 : 330-341.

BRIGGS, P., AUSTIN, S., UNDERWOOD, G. The effects of sentence context in good and poor readers: A test of Stanovich's interactive-compensatory model. *Reading Research Quarterly* 20(1), Fall 1984 : 54-61.

DUMONT, J.J. *Leerstoornissen*: Deel 2. Diagnostiek en behandeling. Rotterdam : Lemniscaat, 1976.

FITZGERALD, J., SPIEGEL, D.L. Enhancing children's reading comprehension through instruction in narrative structure. *Journal of Reading Behavior* 15(2), 1983 : 1-17.

GOODMAN, K.S. The process and practice of reading. *Becoming readers in a complex society*. Chicago: University of Chicago Press, 1984 : 79-114. (Eighty-third Yearbook of the National Society for the study of education)

GREYLING, P.J., JOUBERT, J.J. *Vakdidaktiek van leesonderrig vir die junior primêre fase*. Pretoria : De Jager-HAUM, s.a. : 19 et seq.

MORRISON, F.J. Word decoding and rule-learning in normal and disabled readers. *Remedial and special education* 5(3), 1984 : 20-27.

ONEY, B., GOLDMAN, S.R. Decoding and comprehension skills in Turkish and English: effects of regularity of grapheme-phoneme correspondences. *Journal of Educational Psychology* 76(4), 1984 : 557-568.

OTTO, J. The new debate in reading. *The Reading Teacher* 36(1), Oct. 1982 : 14-18.

PERFETTI, C.A. Some reflections on learning and not learning to read. *Remedial and special education* 5(3), May/June 1984 : 34-38.

POSTHUMUS, M.J. Die klankleer van Afrikaans. In: VAN DER MERWE, H.J.J.M. *et al*. *Afrikaans: sy aard en ontwikkeling*. Pretoria : Van Schaik, 1972 : 146-168.

REITSMA, P. Sound priming in beginning readers. *Child Development* 55(2), Apr. 1984 : 406-422.

SOUTHGATE, V., ARNOLD, H., JOHNSON, S. *Extending Beginning Reading*. London : Heinemann Educational Books, 1981.

STANOVICH, K.E. The interactive-compensatory model of reading: a confluence of developmental, experimental, and educational psychology. *Remedial and special education* 5(3), May/June 1984 : 11-18.

STANOVICH, K.E., CUNNINGHAM, A.E., FEEMAN, D.J. Relation between early reading acquisition and word decoding with and without context: a longitudinal study of first-grade children. *Journal of educational psychology* 76(4), 1984 : 668-677.

VELLUTINO, F.R., SCANLON, D.M. Converging perspectives in the study of the reading process : reaction to the papers presented by Morrison, Siegel and Ryan, and Stavonich. *Remedial and special education* 5(3), May/June 1984 : 39-44.

PARENTAL INVOLVEMENT IN THE EDUCATION OF GIFTED CHILDREN

J.B. HAASBROEK

1. ORIENTATION

Since giftedness is a complicated, multi-faceted and controversial subject, about which opinions frequently differ, parents, the community in general and even teachers are largely ignorant and even indifferent in regard to giftedness as a special ability that children have. In the case of gifted children, parents, teachers and the general community often do not know *who* gifted children are, *what* their formal and formative educational needs are, *how* they differ from other children, *how* they should be approached in the educational situation, and whether they should be approached differently from other children (RGN 1986: 294). This state of affairs often means that gifted children are, consciously or unconsciously, ignored and that their educational needs do not receive attention (RGN 1986: 294).

The successful progression of education for gifted children is not only determined at school, but also depends on the attitude adopted by their parents to gifted children and their education.

The question that now arises is what is meant by giftedness and gifted children (pupils/persons). Giftedness may be qualified as a special potential or ability that a person has to do exceptionally well in various fields or only one field. Giftedness is thus the comprehensive concept embracing all abilities that give rise to exceptionally high performance. In the light of this definition of giftedness, gifted children (pupils) are qualified as those children (pupils) who are able, because of their talents or realized superior intellectual capacity or other human potentialities, continually to produce an outstanding performance in various fields (school subjects and/or extramural activities) or in only one field (school subject or extramural activity), and who distinguish themselves on the grounds of their outstanding achievements (cf. RGN 1986: 29-30; Haasbroek and Jooste 1980 : 14-16; Gifted and Talented Children's Education Act (USA) Section 2, 1978).

If parents and teachers comprehend the nature and essence of gifted children and know how to handle them, this can contribute to education that meets the needs of such children.

Since parents and teachers are on a partnership footing when the education of children and thus also the education of gifted children is at issue, the following matters of importance to parent involvement in the education of gifted children will be elucidated here:

- Actions of parents that have a detrimental effect on their involvement in the education of their gifted children.
- Parents' need for knowledge about the nature and essence of giftedness and the provision of special education for gifted children.
- The aim of providing parents with guidelines on how to handle their gifted children.
- Ways in which parents can handle their gifted children.
- The necessity of co-operation and liaison between parents and teachers regarding the education of gifted children.

2. ACTIONS OF PARENTS THAT HAVE A DETRIMENTAL EFFECT ON THEIR INVOLVEMENT IN THE EDUCATION OF THEIR GIFTED CHILDREN

2.1 THE OVEREMPHASIZING BY PARENTS OF THE EXCEPTIONAL INTELLECTUAL AND OTHER POTENTIALITIES OF GIFTED CHILDREN

It sometimes happens that the parents of gifted children are so impressed with the intellectual and other potentialities of their children that they show a lack of perspective in this regard. In such cases the following may happen (Vernon, Adamson and Vernon 1977: 109-110; Schwartz 1981: 34-35; RGN 1986: 308-309):

- Parents tend to present their children with too many "enriched" learning experiences, with the result that *other* needs are not adequately met.

- Parents overestimate their gifted children and put pressure on them to produce a better performance than the children are actually capable of.

- Parents overemphasize the exceptional achievements of their gifted children, with the result that the gifted children start to develop an unrealistically high opinion of themselves and even become excessively and unacceptably egotistical.

- The children of parents who shower praises on the slightest manifestation of exceptional ability ignore the praise as empty rhetoric.

- The overemphasis by parents of the achievements of one child in a particular family at the expense of the other children gives rise to strained relations with the other children in the home and even with the peer group.

- Excessive praise has the result that a gifted child tries to outdo other children at all costs, and even makes offensive comparisons between his own performance and that of others.

All children, gifted children as well, need challenges, but they must also realize that they may fail, and should therefore be guided to accept *failures* too. Parents who manipulate the primary educational situation (parental home) to such an extent that children have to achieve success in *all* fields are in reality not contributing to the development of their children's abilities. Parents sometimes see their gifted children as extensions of themselves and want, through their children, to erase their own frustrations and realize their own unattainable ideals. As a result of this propensity of parents they exert unnatural and unrealistic pressure on their children to attain achievements that represent the wishes of the *parents* (Ross in Colangelo and Zaffrann 1979: 405).

From the above it is clear that parents through overenthusiasm may lose perspective in regard to the actual abilities of their children. Irresponsible action by parents disadvantages the gifted child.

2.2 THE UNDEREMPHASIS BY PARENTS OF THE EXCEPTIONAL INTELLECTUAL AND OTHER POTENTIALITIES OF GIFTED CHILDREN

Some parents, because of their awkwardness in the handling of their gifted children, feel that it is better to do nothing, and proceed from the standpoint that their children will achieve success at school *by themselves* because of their special abilities. The underemphasis by parents of the exceptional intellectual and other potentialities of gifted children may have the result that the educational needs of gifted children do not receive attention. It is clear that parents must be informed how to maintain a balance between overemphasizing and underemphasizing the exceptional abilities of their gifted children (RGN 1986: 310; Sumption and Luecking 1960: 133).

2.3 THE UNJUSTIFIED EXPLOITATION BY PARENTS OF THE INTELLECTUAL AND OTHER POTENTIALITIES OF GIFTED CHILDREN

Some parents see their gifted children as status symbols and their children's exceptional intellectual and other potentialities are to the parents something with a high prestige value. These parents often put unrealistic pressure on their children to achieve. Such action by parents may elicit unfavourable reactions in their gifted children, which leads to behavioural problems (RGN 1986: 310; Haasbroek and Jooste 1981: 52).

2.4 UNCERTAINTY AMONG PARENTS REGARDING THE HANDLING OF GIFTED CHILDREN WITH EXCEPTIONAL CREATIVE ABILITIES

Parents are (often) uncertain about what creative intellectual abilities are, what the nature of the creative process is, and how creative abilities are evinced. Often the ways in which creative abilities are revealed bring gifted children into conflict with parents, the school, the peer group and the community. Gifted children with exceptional creative abilities experience great difficulty in conforming, because they themselves have a need for independence and non-conformity. The increased tension that accompanies this situation may have the result that these children do not develop their creative abilities and become excessively conformist and dependent, which hampers the development of the self-concept and may lead to learning and behavioural problems (RGN 1986: 311; Gowan, Khatena and Torrance 1981: 24).

2.5 PROBLEMS WITH RELATIONSHIPS WITHIN THE FAMILY

The parents of gifted children frequently experience problems with the relationships between their children. Often they do not know how to meet the educational needs of their gifted children in such a way that other children in the household who are not gifted do not feel neglected. All the children in a particular family, the non-gifted children as well, need acceptance and understanding and want to experience the feeling that they are making a unique and meaningful contribution to family life. It often happens that one gifted child in the household will completely overshadow the other children. All children, and this includes gifted children, are sensitive to any strain in the relationship between their parents. They also tend to be hypersensitive and tense if confronted too early with social problems. If there are feelings of rejection and enmity in the family circle, the social development of gifted children may be hampered (RGN 1986: 312; Müller 1979).

2.6 SPECIFIC ATTITUDES THAT MAY BE ENCOUNTERED AMONG PARENTS OF GIFTED CHILDREN

Although many parents of gifted children positively accept the fact that these children have exceptional intellectual and other potentialities, there are parents who experience their gifted children as a threat or a problem (Schwartz 1981: 31). Parents are often so overwhelmed by the intellectual and other exceptional potentialities of their gifted children that they are unsure of themselves and show a lack of self-confidence in the encounter with their children (Kruger 1979: 60-61).

Gifted children make special demands on their parents' knowledge, and want to move and converse on the level of their parents and even other adults. Parents often feel inferior because they cannot handle such "strange" behaviour in their children.

203

Parents feel *threatened* by the exceptional intellectual and other human potentialities of their gifted children, because the children often *demonstrate* that they have abilities superior to those of their parents and are able to suggest solutions to problems that their parents would not be able to suggest. Parents who themselves *show an exaggerated need for achievement* and then experience overshadowing by their gifted children feel that their pride has been hurt, manifest aggression towards and feel threatened by their gifted children. This may have the result that gifted children withdraw from competitive activities and express their abilities in fantasy or in "safe" fields where they are not exposed to criticism and humiliation (RGN 1986: 314; Greenstadt 1981: 79-80; Ross 1979: 406).

3. PARENTS' NEED FOR KNOWLEDGE ABOUT THE NATURE AND ESSENCE OF GIFTEDNESS AND THE PROVISION OF SPECIAL EDUCATION FOR GIFTED CHILDREN

3.1 THE NEED FOR KNOWLEDGE ABOUT THE NATURE AND ESSENCE OF GIFTEDNESS

Sufficient knowledge about the nature and essence of giftedness can clear up prejudices, misapprehensions and misunderstandings about giftedness and promote the formation of positive attitudes, because parents will realize the uniqueness of each gifted child. Parents will realize that although gifted children have exceptional intellectual abilities and other potentialities, they are entitled to formal and formative education that will fulfil their needs.

For this reason it is important for parents to be aware of the fact that gifted children, because of their high intellectual capacity and other exceptional potentialities, will produce exceptional achievements in their own individual ways and in different fields. It is also important for parents to be informed about the ways in which gifted children can be identified, and to know that parents have a contribution to make in the identification of gifted children (RGN 1986: 301).

3.2 THE NEED FOR KNOWLEDGE ABOUT THE NATURE OF SPECIAL EDUCATION PROVIDED FOR GIFTED CHILDREN

In regard to the provision or special education for gifted children, negative dispositions, orientation and attitudes among parents can also be eliminated by informing parents, so that they will realize that (RGN 1986: 301-302) -

- all education - including education for gifted children - must meet the educational needs of the children;
- the educational needs of gifted children are not fully met by the "traditional" curriculum, forms of education and strategies, and the usual mainstream education;
- the unique educational needs of gifted children can best be met by the provision of special education;
- education for gifted children does not have the aim of unjustifiably benefiting these children above normal children, or of establishing an intellectual elite group;
- parents should be informed of the nature of special education provided for gifted pupils, the broad principles on which the curriculum is based and the aim of such a curriculum;
- education provided for gifted children is not aimed at the one-sided development of their abilities, but is intended to develop the whole person;
- education provided for gifted children would challenge the children to achieve and should call out the best in them.

4. THE AIM OF PROVIDING PARENTS WITH GUIDELINES ON HOW THEY CAN HANDLE THEIR GIFTED CHILDREN

The aim of providing parents with guidelines on how to handle their gifted children is to lay down specific principles according to which parents should approach and handle their gifted children so as to establish a positive educational climate and relationship which will give gifted pupils the optimum support in developing their special potentialities to the full in their education. Guidelines on ways of handling gifted children are given to parents so that they (RGN 1986: 316-317) -

- will be enabled to create in the parental home (primary educational situation) an educational climate such that an adequate educational relationship can arise in which the needs of gifted children can be met;
- will be able to recognize, acknowledge and respect the exceptional intellectual and other potentialities of their gifted children, as well as their limitations;
- will be enabled to evaluate their children's abilities realistically;
- will be able to strike a balance between overemphasizing and underemphasizing the exceptional abilities of their children;
- will be able to realize that their children cannot be allowed to develop one-sidedly as a result of one-sided emphasis on certain abilities (e.g. cognitive development);
- will be able to offer their children support in developing their specific forms of giftedness in particular;
- will be able to support their children in developing their creative abilities;

- will be able to establish the necessary disciplinary and authority structures within which giftedness can develop optimally and positively;

- will not feel threatened by the exceptional intellectual and other potentialities of their gifted children because of their own awkwardness, ignorance, uncertainty or prejudice.

4.1 GUIDELINES FOR THE ESTABLISHMENT BY PARENTS OF A POSITIVE EDUCATIONAL CLIMATE AND RELATIONSHIP

It is of the utmost importance for the parents of all children (whether gifted or not) to realize that they should make a constructive and positive contribution to the formal and formative education of their children and should in addition remain involved before and especially after the children have started school. It is also important for parents to realize that they continue to be the primary educators of their children and that this responsibility can never be delegated exclusively to the school. The school is in this regard merely an extension of the parental home (RGN 1986: 317).

An educational climate and relationship in the parental home that promote development of the self-concept and self-actualization in the child is a precondition for successful education. That is why parents must guide and support their children in such a way that (RGN 1986: 317) -

- children can *experience* the complete and unconditional *acceptance* of their parents;

- children can experience the *love* of their parents and experience the home environment as *safe;*

- children can experience the existence of understanding for their special abilities and needs and the positive but realistic evaluation of their parents;

207

- children can be brought to realistic self-evaluation and self-acceptance;

- an educational relationship can be established that evinces mutual respect and a relationship of authority.

While these principles apply to the education of all children, it is important for parents to bear in mind that the educational needs of gifted children largely coincide with those of other children (Vernon, Adamson and Vernon 1977: 127 - 129).

4.2 GUIDELINES FOR PARENTS ON ACQUIRING THE NECESSARY PERSPECTIVE IN REGARD TO THEIR GIFTED CHILDREN

It has already been pointed out that knowledge about giftedness, gifted children and education for gifted children is of crucial importance for the formation of positive attitudes, and it may be concluded that parents should be informed about (RGN 1986: 319) -

- the nature and essence of giftedness;

- the characteristics and needs of gifted children;

- the nature of education for gifted children;

- the nature of the human striving to achieve;

- the importance of the development of the self-concept and self-actualization;

- the importance of establishing an adequate educational climate, and

- the nature of the educational relationship that optimizes the actualization of abilities.

As with children in the home who are not gifted, parents must positively acknowledge, be aware of and appreciate the exceptional intellectual and other potentialities of their gifted children, and should not lose perspective in this connection. In regard to the provision of special education for gifted children, there should be a sincere attempt to give these particular children the opportunity to become, in accordance with their own abilities, the *somebody* they *ought* to be (Pasques, Boshoff and Nel 1983: 1).

Parents should bear in mind that their gifted children are not status symbols; their special gifts are *gifts of grace*. Also, such children are not extensions of their parents, and consequently the ideals parents were unable to attain ought not to be attained *through* their children. Gifted children have thus not received their exceptional gifts in order to fulfil the unrealised ambitions of their *parents* (Pasques, Boshoff and Nel 1983: 1).

Parents must also know both the potentialities and the shortcomings of their gifted children and should also evaluate them realistically, *retaining* the necessary perspective. They should view the development of their children's potentialities as a *challenge* and give the children the *opportunity* to bring these to optimal and positive development. In no circumstances should parents be so impressed with the exceptional gifts of their gifted children that they put *unnatural pressure* on them to achieve (cf. Fine 1981: 468-469).

Thus the conclusion may be drawn that parents should preserve a realistic view of the characteristics and needs of their gifted children, should evaluate their children realistically, should expect a realistic performance of them and should give them the opportunity to fulfil these expectations. In this way parents can support their gifted children in realising their exceptional abilities through education (RGN 1986: 318-320).

4.3 GUIDELINES FOR PARENTS ON HOW TO HANDLE GIFTED CHILDREN WHO SHOW EXCEPTIONAL CREATIVE ABILITY

It emerges that parents often do not know how to handle gifted children who may show exceptional creative abilities, with the consequence that negative attitudes may be formed, resulting in the disturbance of the educational relationship. The importance of the development of such abilities in gifted children is universally regarded as a matter of high priority, and the role of the parents as the primary educators in this process is crucial. For this reason it is important for parents to accept the possible creative abilities of their gifted children, not to be threatened by them, and to offer their children the opportunity to develop these abilities. It is therefore important for parents of gifted children with exceptional creative abilities to give the development of such abilities a high priority. In this connection parents may undertake the following (Willings 1980: 111-114; Hildreth 1981: 96-97; RGN 1986: 321):

- Both parents and children should appreciate individual ideas, viewpoints and views.

- Children should be encouraged to experiment with different ideas, to improvise and to fantasise.

- Parents should encourage their children to ask questions, by asking stimulating questions themselves. Clear answers must also be given and children should be guided to seek answers for themselves from other sources.

- Children should be guided by their parents to the realization that well-known objects and matters can also be approached in unconventional ways and that as a result new and unusual associations may be formed.

- In addition, parents should get children to realize that there are often a variety of possible ways of solving the same problem.

- Limiting factors that may restrict the manifestation of creative abilities should be eliminated. In this connection parents should give their children opportunities for self-initiated exploration (naturally within limits), observation, questioning, classifying, drawing conclusions, communicating, fantasizing and using analogical thinking.

- The acquisition of language skills by these children should also receive high priority. In this connection suitable reading matter on fields that interest the creatively gifted child can be supplied.

- Parents should realize the importance of shared family activities and participation in hobbies to the manifestation of creative abilities (RGN 1986: 321).

4.4 GUIDELINES FOR PARENTS IN PROVIDING SUFFICIENT LEARNING OPPORTUNITIES AND EXPERIENCES FOR THEIR GIFTED CHILDREN

Parents often wrongly believe that the provision of learning opportunities and experiences lies exclusively within the domain of the school. However, the home environment is the child's first (primary) learning environment, and therefore it is the responsibility of the parents to make sufficient learning opportunities and experiences available to their gifted children for the development of their giftedness (Karnes and Karnes 1982: 238). In this connection the following may serve as a guide for parents (Clark 1983: 386-391; Schwartz 1981: 31):

- Parents should bear in mind that their gifted children will probably at an early age show a need to obtain knowledge. This need can be met in various ways, for example by selecting and providing suitable reading matter, radio and television programmes, attending meetings, visiting art galleries and using a library.

- It is of the utmost importance for parents to help with the development of their child's language ability. Parents should provide their children with suitable reading matter from an early age to stimulate language ability.

- Parents should also be aware that gifted children even at an early age may tend to explore. Normally these children will flood their parents with questions, which should in no circumstances be discouraged, because the discouragement of exploration may lead to a loss of interest in certain matters. In addition, parents should deal patiently with the curiosity and eagerness for knowledge of their children. Although parents cannot be expected to supply answers to all their children's questions, they should make it possible for their children to master techniques and methods for obtaining such knowledge.

- Furthermore it is important for parents to praise the achievements of their gifted children. It is just as important for such praise to have the ring of truth, because gifted children are especially able to recognize false and rhetorical praises.

- In addition, parents should bear in mind that gifted children need time on their own. Parents should therefore see that their gifted children's daily programme is not so overfull or overscheduled that they have no free time available.

4.5 THE IMPORTANCE OF THE NORMATIVE EXAMPLE SET BY THE PARENTS OF GIFTED CHILDREN

Because the daily life of parents presents their children with normative models of behaviour for, for example, social attitudes, affective norms, purposefulness, self-actualisation, problem solving and the approach to problems, it is of the utmost importance for parents to perform a special function of support and guidance in the development by their children of their own system of values that will lead to the establishment of a *personal philosophy of life* (RGN 1986: 329-330).

4.6 THE IMPORTANCE OF EFFECTIVE COMMUNICATION BETWEEN PARENTS AND THEIR GIFTED CHILDREN

Many of the problems parents have with their gifted children may be traced back to faulty communication between family members. Parents should be aware of the importance of effective communication in the family and should continually try to improve communication.

The effectiveness of communication between parents and children can be enhanced by endeavouring to achieve the following (RGN 1986: 335):

* Parents and children should show understanding for one another's needs.

* There should be an adequate relationship of trust between parents and children.

* Parents and children should be prepared to *listen* to each other with understanding for each other's ideas and feelings.

* Both parties should strive for authenticity in communication.

* Feelings of *tension, impatience, frustration and uncertainty* should be excluded as far as possible because they disrupt true communication.

* Parents and children should be prepared to consider *different* and even *contradictory points of view* about a matter.

* Different views of a matter should be *respected*.

Striving to achieve the behaviour described above can lead to the establishment of better communication and better relations in the family, which will in turn lead to better communication and better functioning in the school and the community (RGN 1986: 335).

5. WAYS IN WHICH PARENTS CAN HANDLE GIFTED CHILDREN

In the previous sections the problematic conduct of parents in regard to their gifted children, parents' need for knowledge about giftedness and guidelines for the handling of gifted children by parents were dealt with. The most important ways in which parents should treat their gifted children are the following (RGN 1986: 340-344):

- Parents should understand that, just like other children, gifted children also need understanding, acceptance, love, trust, security, safety and authority. Parents should ensure that such a relationship is realized in the parental home.

- Parents should see to it that the educational situation in the parental home is such that gifted children can come to optimal and positive development of the self-concept and self-actualization.

- Parents should evaluate realistically the potentialities and limitations of gifted children and take responsibility for bringing the exceptional intellectual and other potentialities of these children to development through setting realistic goals.

- Parents should notice, accept and show appreciation for the differences between individual children.

- The home environment should be a safe refuge for children, since there is a possibility that gifted children may be rejected by the peer group, teachers and the community because they are different.

- Parents should realize that they share the responsibility for the optimal development of the exceptional intellectual and other potentialities of their gifted children, and that this responsibility cannot be entrusted entirely to the school.

- Parents should also help with the constructive channeling of creative abilities, because such abilities can be employed both constructively and destructively.

- Parents should give gifted children enough support when they doubt their own abilities or experience disappointment, so that the children will be able to overcome such setbacks.

- Gifted children should be *encouraged* to strive after achievement.

- Parents should also offer their children sufficient learning opportunities and experiences by stressing the early development of the ability to express themselves verbally, providing suitable reading matter so that the children can have access to knowledge, arranging educational outings to, *inter alia*, art galleries, museums and educational institutions, giving meaningful answers as far as possible to the many questions asked by these children, and finding meaningful channels for the wide interests of their gifted children.

- Setting a suitable normative example in daily life is most important. Parents must see that they *live* the values they *advocate*.

- It is also important for parents to be determined to keep the communication channels in the home open.

- Parents should guide their children to accept and handle their own differentness.

- Parents should guide and support their children in seeing, accepting and appreciating the differences between individuals.

- Parents should also guide their children to accept and process failures and disappointments.

- Very often it is found that gifted children show a greater awareness of and concern about problems in the adult world. They are frequently very worried about political and moral matters. It is highly important for parents to provide guidance and support in this respect.

- Parents should also see to it that their gifted children establish the correct relationships with members of the family, the peer group, teachers and other adults.

- Parents should avoid structuring the child's day excessively so that the child has no free time available.

6. CO-OPERATION AND LIAISON BETWEEN PARENTS AND TEACHERS REGARDING THE EDUCATION OF GIFTED CHILDREN

To promote co-operation and liaison between parents and teachers in regard to the formal and formative education of gifted pupils, the following strategies may be considered (RGN 1986: 368-369):

- *The distribution of newsletters*: Schools can from time to time produce for parents and the community in general newsletters/ informative documents about giftedness, gifted pupils and education for gifted pupils.

- *Making "manuals" available to parents of gifted children:* Schools can make available to parents "manuals" giving information about *inter alia* the definition of giftedness, ways of identifying it, the provision of education for gifted pupils, ways in which parents can promote the development of giftedness, how parents can handle gifted children, and the correct attitudes for parents towards their gifted children.

- *Meetings and interviews*: It is important to provide parents from time to time, individually and in groups, with guidance about giftedness. Such personal contact with teachers and other experts on giftedness *demonstrates* to parents that the school (education department) takes an interest in their gifted children.

- *Educational outings:* Parents should be involved with these activities when their gifted children are participating. This brings about contact between parents and teachers on a more informal level.

- *Courses for parents:* Short courses for parents on the education of their gifted children should be presented from time to time.

- *Continuation of school activities at home:* It is important for parents to try to contribute to the formal education of their children at school. Close liaison with the school can indicate to parents which home activities can supplement the education at school. Schools may give structured guidance to parents on this matter.

- *Progress reports:* Teachers should send reports to parents regularly on the progress of their gifted children.

- *Study groups:* It is important for teachers to support parents in setting up study groups for parents of gifted children. Such study groups can on the one hand provide support for teachers through collecting and disseminating information about giftedness, gifted children and education for gifted children, and on the other hand give parents an opportunity to extend their knowledge of giftedness.

7. ASPECTS THAT SHOULD BE CONSIDERED BY EDUCATION AUTHORITIES

7.1 THE FORMULATION OF A POLICY ON PARENT INVOLVEMENT IN THE EDUCATION OF GIFTED CHILDREN

Strategies for supplying parents with information about the nature of giftedness, the characteristics of gifted children and the provision of education for gifted children should be included in the education policy.

7.2 METHODS OF SUPPLYING INFORMATION ABOUT THE EDUCATION OF GIFTED CHILDREN

Schools should be given guidelines for the content of lectures for study groups, seminars and symposiums, and should be supplied with brochures so that they can compile informative documents for parents on giftedness, gifted children and education for gifted children, to inform parents about the following matters:

- the nature and essence of giftedness,
- the nature of special education provided for gifted children,
- characteristics and needs of gifted children,
- the formation of the self-concept and self-actualisation, and
- the establishment of an educational relationship that optimises the actualization of the child's exceptional abilities.

7.3 SPECIFIC INFORMATION FOR PARENTS

It is important for parents to realise that they continue to be the primary educators of their children and that this task remains their responsibility even after their children have started school. In this connection it is important for parents to establish an educational climate and relationship that will optimize self-development, positive and realistic formation of the self-concept and self-actualization in the child. Parents must be informed how to treat their gifted children, and this information should orientate parents in such a way that, in regard to their gifted children, they will -

- positively approach and encourage the exceptional creative abilities of their gifted children;
- provide their gifted children with sufficient learning opportunities and experiences;

- establish adequate family relationships;

- ensure that the normative example they set is worthy of imitation;

- establish effective authority structures;

- bring about effective communication between parents and children, and

- not permit the one-sided development of their gifted children's abilities.

8. CONCLUSION

The discussion above attempted to cover parent involvement in the education of gifted children. Problems parents experience in handling their gifted children were stated, and guidelines for the elimination of such problems were given.

REFERENCES

CLARK, Barbara. Growing up gifted: developing the potential of children at home and at school. 2nd. ed. Columbus : Merrill, 1983.

FINE, M.J. Facilitating parent-child relationships for creativity. In: BARBE, W.B., RENZULLI, J.S. Psychology and education of the gifted. 3rd. ed. New York : Irvington Publishers, 1981 : 468-649.

GOWAN, J.C., KHATENA, J., TORRANCE, E.P. Creativity: its educational implications. Dubuque : Kendall/Hunt, 1981.

GREENSTADT, W.M. Parents of gifted children: coping with anxieties. In: MILLER, B.S., PRICE, Merle. The gifted child, the family, and the community. New York : Walker, 1981 : 79-80.

HAASBROEK, J.B., JOOSTE, J.H. Die identifisering van hoogbegaafde leerlinge met verwysing na onderwysprogramme in die opleiding van onderwysers. Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1981.

HILDRETH, Gertrude H. The creative child at home. In: MILLER B.S., PRICE, Merle. The gifted child, the family and the community. New York : Walker, 1981 : 96-97.

KARNES, Frances A., KARNES, M.R. Parents and schools: educating gifted and talented children. *The Elementary School Journal* 82(3), Jan. 1982 : 263-243.

KRUGER, J.C. Die begaafde kind in die gesin. In: MÜLLER, N.J. *Die begaafde kind*. Pretoria : Universiteit van Suid-Afrika, 1979 : 60-61.

MÜLLER, N.J. *Die begaafde kind*. Pretoria : Universiteit van Suid-Afrika, 1979.

PASQUES, L.J., BOSHOFF, W.J., NEL, J.F. *Kurrikulering vir hoogbegaafde leerlinge*. Werkkomitee: Onderwys vir begaafde leerlinge. Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1983.

RAAD VIR GEESTESWETENSKAPLIKE NAVORSING (RGN). *Onderwys vir begaafde leerlinge*. (Redakteur J.B. Haasbroek) Pretoria : Raad vir Geesteswetenskaplike Navorsing, 1986.

ROSS, A.O. The gifted child in the family. In: COLANGELO, N., ZAFFRANN, R.T. *New voices in counseling the gifted*. Dubuque : Kendall/Hunt, 1979 : 405.

SCHWARTZ, Lita L. Are you a gifted parent of a gifted child? *Gifted Child Quarterly* 25(1), Winter 1981 : 34-35.

SUMPTION, Merle R., LUECKING, Evelyn M. *Education of the gifted*. New York : Ronald Press, 1960.

VERNON, P.E., ADAMSON, Georgina, VERNON, Dorothy F. *The psychology and education of gifted children*. London : Methuen, 1977.

WILLINGS, D. *The creatively gifted: recognizing and developing the creative personality*. Cambridge : Woodhead-Faulkner, 1980.

A BRIEF REPORT ON SOUTH AFRICAN MATHEMATICS OLYMPIAD MEDALLISTS FROM 1966 TO 1983

P.G. LE ROUX

1. INTRODUCTION

In a study of this nature, aimed at (i) establishing a profile of the Mathematics Olympiad medallists as a group of gifted pupils and (ii) determining the extent to which the purpose of the Olympiad has been realized, a few introductory remarks about the gifted pupil are necessary.

There is a worldwide awareness of the fact that particular attention should be paid to gifted children to ensure that their potential will be fully developed to the advantage of the entire community. "The nation's greatest resource for solving critical national problems in areas of national concern is its gifted and talented children: unless the special abilities of gifted and talented children are developed during their elementary and secondary school years their potentials for assisting the nation may be lost" (The United States Gifted and Talented Children's Education Act of 1978, in Neethling 1981:4-5). "...I think that our ability to meet the challenge of the future will depend upon our recognition of the kinds of human giftedness that we shall need" (Parkyn 1976:35). Note that not only superior intellectual ability, but also other forms of giftedness are referred to.

In South Africa too, a large number of educationists support this idea of paying special attention to the education of gifted children and are in fact taking the lead in this field. A major problem in school practice is that gifted children often receive no special attention and that their enthusiasm is frequently curbed by misguided teachers, causing them to withdraw and become underachievers (in respect of their own abilities). Lyon illustrates this as follows:

"Each spring in our nation's capital, Washington DC, a giant bed of several thousand tulips - a gift from the Netherlands - begins to blossom near the tidal basin in a race for glory with the cherry blossoms. My daily sojourn to work in rush-hour traffic brings me alongside this tulip bed. One morning this spring I noticed that ten to fifteen tulips had begun to blossom a few weeks before the main body of the tulip bed. On my way home from work that evening, I observed a National Park gardener on his hands and knees in the tulip bed clipping off the blossoms of the early bloomers so as to maintain uniformity. I was struck by the obvious analogy to be drawn from our nation's classrooms, where early-blooming gifted and talented youth often have their blossoms clipped by their teachers in their desire to keep their students and classrooms in tune with our traditional lock-step educational system" (Lyon 1976:20). (See Figure 1.)

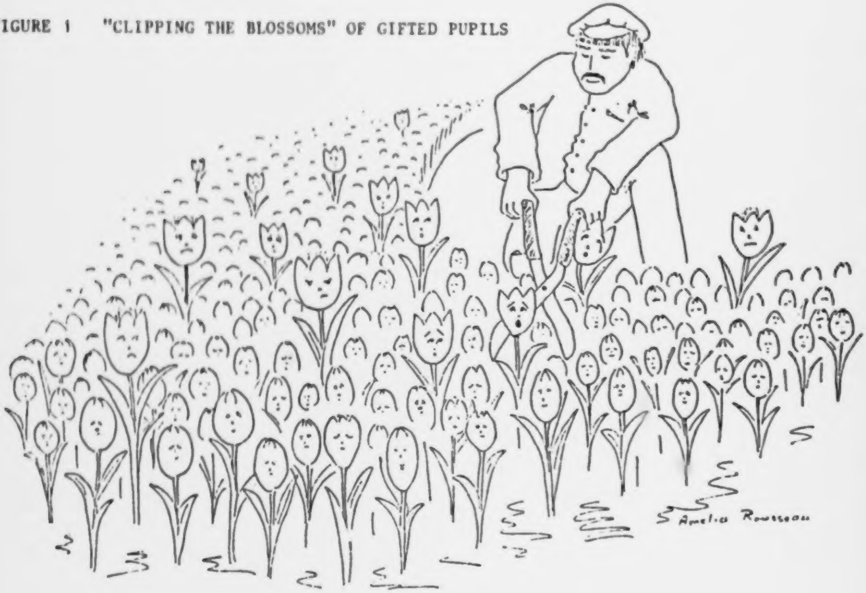


FIGURE 1 "CLIPPING THE BLOSSOMS" OF GIFTED PUPILS

In order to set in motion the process of paying special attention to the gifted child, mechanisms had to be developed to (i) identify these pupils and (ii) to satisfy their need to develop their particular talents. With the introduction of the Mathematics Olympiad, for which a need had long been apparent, we have indeed succeeded in creating such a mechanism.

2. PURPOSE AND ORGANIZATION OF THE MATHEMATICS OLYMPIAD

The Suid-Afrikaanse Akademie vir Wetenskap en Kuns, the body responsible for the introduction of the Mathematics Olympiad in 1966, explained the purpose of the Olympiad as follows: "Die Suid-Afrikaanse Akademie vir Wetenskap en Kuns beoog om met sy Wiskunde-olimpiade die liefde vir Wiskunde te stimuleer en om jeugdige talent en aanleg tydig te ontdek en te bekroon" (HSRC 1971a:1). Although a number of additional aims were later formulated, they do not fall within the scope of this article and will therefore not be discussed here.

An olympiad of this nature is eventually directed at a small number of star performers, the mathematically gifted. The degree of difficulty of the Olympiad is far beyond the ability of pupils with an average or below average talent for Mathematics (HSRC 1971a:2). Should this group of pupils be allowed to participate freely in the Mathematics Olympiad, the resultant feelings of frustration and failure would probably cause more harm than good. Although talent is the decisive prerequisite for achievement in the Mathematics Olympiad, it should be remembered that this talent needs instruction and practice to develop to its full potential. The difference between the Mathematics Olympiad and Mathematics examinations at schools lies mainly in the fact that whereas in the latter achievement is determined largely by the pupil's knowledge of the subject and its application in solving relatively standard problems, the former requires original thought (Malan 1971:7). It is for this reason that schools are requested time and again to enter only their most promising candidates. Those pupils who annually obtain the highest scores in the second (final) round (usually ten are selected, provided that the level of achievement justifies such a high number), receive the Dirk van Rooy medal awarded by the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (one gold for the overall winner and nine silver medals for the runners-up).

The statistical data in respect of medallists over the period 1966 to 1983 given below were obtained by means of questionnaires. Owing to changes of address or other reasons, some questionnaires were returned unopened, while others were not returned at all, so that in such cases we had to make do with the basic information at our disposal.

3. SOME PARTICULARS IN RESPECT OF MEDALLISTS FOR THE PERIOD 1966 TO 1983

3.1 GENERAL

3.1.1 Entry

Judging by the number of entries received for the first round of the Mathematics Olympiad, this special exercise in Mathematics was popular from the very start. During the 18 years covered by this survey (1966 to 1983) the average number of entries for the first round was 3 790 pupils a year (approximately 8,7 % of all white Std 10 pupils*). Of these pupils an average of only 101 a year (i.e. 2,7 %) reached the second round (see Figure 2). The number of schools from which pupils competing in the first and second rounds were drawn, was 413 and 60 respectively - this represents 50 % and 7 % respectively of the total number of white secondary schools in the RSA.

Since 1971 the Mathematics Olympiad has been open to all four population groups, including pupils from the black national and independent states. However participation by blacks and coloureds has until recently been relatively insignificant (see Figure 3).

---

* Since the number of medallists among the Std 10 pupils of other population groups is at present too small for calculating a meaningful ratio for each population group, they are not being included at this stage.

FIGURE 2 NUMBER OF PARTICIPANTS IN THE FIRST AND SECOND ROUNDS OF THE MATHEMATICS OLYMPIAD AND THE NUMBERS OF MEDALLISTS: AVERAGE PER YEAR FOR THE PERIOD 1966 TO 1983

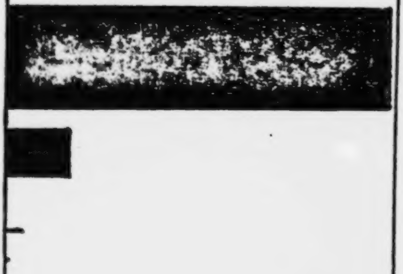
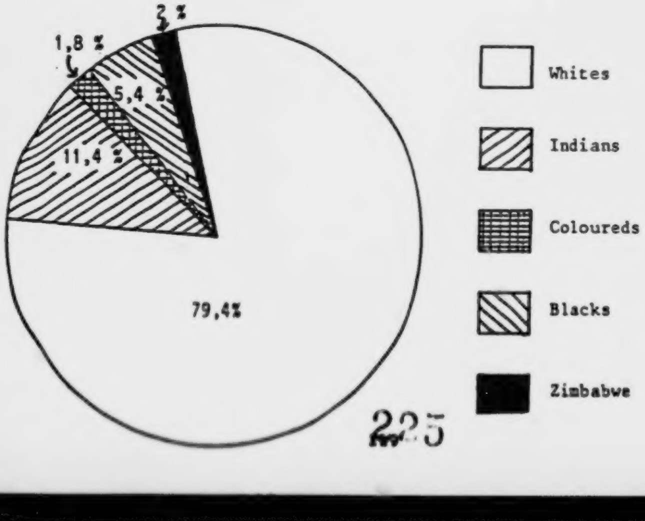
Group	Average number of pupils per year	Number of pupils represented as an area
White Std 10 pupils (average per year over a period of 18 years)	43 786	
First round	3 790	
Second round	101	
Medallists	9,1	

FIGURE 3 ENTRIES FROM THE VARIOUS POPULATION GROUPS FOR THE FIRST ROUND OF THE MATHEMATICS OLYMPIAD: AVERAGE FOR THE PERIOD 1981 TO 1983



3.1.2 Number of medallists

Since the introduction of the Mathematics Olympiad in 1966, up to and including the 1983 Olympiad, there have been 164 medallists. Eight of these pupils were awarded medals twice, while two others achieved this distinction three times - one, a boy from the Cape Province, in 1967 1968 and 1969, and the other, a girl from the Transvaal, in 1976, 1977 and 1978.

3.1.3 The sex of medallists

Despite research findings revealing that there is little difference between the intellectual abilities of boys and girls (Widdup 1981:23), the majority of winners by far have until now been boys (154, i.e. 93,9 % compared to 10, i.e. 6,1 %). There are three possible reasons for the unrealistically low percentage of girls among the medallists, which will be discussed briefly below.

In the first place it appears that a positive relation exists between spatial and abstraction aptitude and self-confidence. Since girls generally grow up more protected than boys, the majority of girls reveal signs of underdeveloped spatial aptitude and daring (Widdup 1981:23). In the second place it was revealed by the same study that, particularly among girls, this lack of self-confidence results in a high anxiety level that stimulates achievement at primary school level, but hampers it at secondary level (Widdup 1981:23). A third possible explanation is that during adolescence Mathematics is often labelled a masculine field of study and that this stereotyping contributes considerably to the difference in mathematics achievement behaviour between girls and boys (Visser 1985:258).

3.2 BACKGROUND OF MEDALLISTS

3.2.1 Home language

As seen in Figure 4, the majority of the 164 medallists - including Indians, coloureds and immigrants - indicated English as their home language. Among the group labelled "other" there are those who indicated German, Zulu, Chinese and Japanese as their home language. Now take a look at Figure 5. It is interesting to note that from the start considerably more English-speaking than Afrikaans-speaking pupils have been involved even in respect of entries received for the first round of the Mathematics Olympiad. It is obvious that Afrikaans-speaking pupils and Afrikaans medium schools should be encouraged to show greater interest in participating in Mathematics Olympiads.

3.2.2 Qualifications and occupations of the parents of medallists

The information in this paragraph is based on questionnaires completed and returned by 123 medallists. These revealed that the majority of the fathers of these 123 medallists practised high-level occupations, 21,2 % were involved in engineering, architechture and related fields 19,5 % practised professions in the educational sphere and 17,9 % were management scientists (see Figure 6). The other professional groups were less well represented.

In respect of medallists' mothers it appeared that 74 % were trained for or were in fact active in professional or semi-professional occupations. The two major groups were the housewives (28,5 %) and educationists (26,0 %). The occupations of the remaining 26,0 % of mothers were recorded in Figure 6.

A look at qualifications as presented in Figure 7 reveals that 26,0 % of all medallists' fathers had no higher qualifications than some or other pretertiary school certificate, that 7,3 % had obtained some or other diploma, and that 66,7 % held university degrees (those in engineering occurred most frequently, i.e. in 31,7 % of all graduates).

In respect of the mothers it reveals that while 42,3 % held no higher qualifications than some or other pretertiary school certificate, 26,8 % had obtained some kind of diploma and 30,9 % were university graduates (the majority 57,9 % of the university graduates, having obtained degrees in the Arts). (See Figure 7.)

FIGURE 4: HOME LANGUAGE OF MEDALLISTS

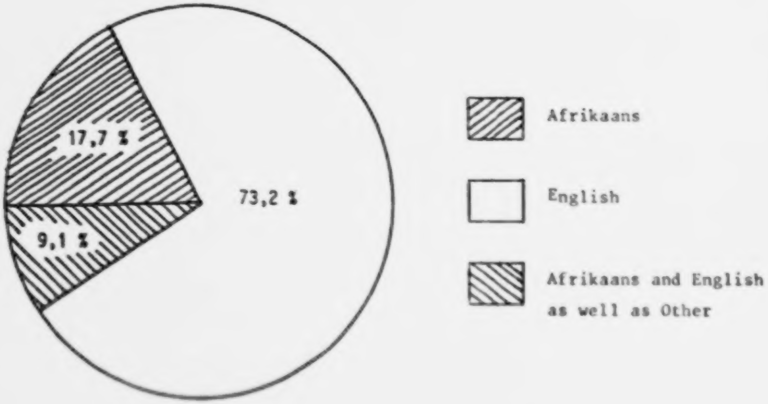


FIGURE 5: FIRST ROUND ENTRIES ACCORDING TO HOME LANGUAGE: AVERAGE FOR 1981 TO 1983

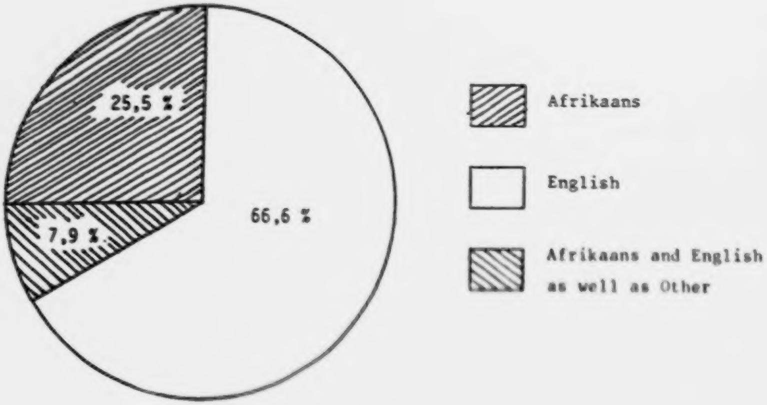


FIGURE 6: OCCUPATIONS OF MEDALLISTS' MOTHERS AND FATHERS ACCORDING TO PERCENTAGE

Occupation	Mothers %	Fathers %
Technical occupations	-	4,9
Management Science	3,3	17,9
Farming	0,8	4,1
Religious	-	4,9
Commerce	8,1	8,1
Housewife	28,5	-
Engineering, Architecture and related professions	1,6	21,1
Clerical	2,4	1,6
Communication	2,4	2,4
Medical	8,9	5,7
Research	2,4	0,8
Educational	26,0	19,5
Law	-	1,6
Secretarial	11,4	-
Social Science	3,3	0,8
Numeracy	0,8	5,7
Transport	-	0,8
TOTAL	100	100

FIGURE 7: HIGHEST QUALIFICATIONS OF MOTHERS AND FATHERS OF MEDALLISTS ACCORDING TO PERCENTAGE

Qualification group	Mothers %		Fathers %	
School certificates (Standards 6 to 10)	42,3		26,0	
Diplomas	26,8		7,3	
B.degrees	21,1	30,9	35,0	66,7
Honours degrees	6,5		1,6	
M.degrees	3,3		17,1	
D.degrees	-		13,0	
TOTAL	100		100	

3.3 SCHOOL EDUCATION

3.3.1 Schools attended : types of schools and province

A look at the school education of medallists reveals that of the total of 164 medallists 86 (i.e. 52,4 %) attended provincial schools whereas 78 (47,6 %) were pupils at private schools or schools subsidized by the provincial administration. On the basis of a calculation of the proportionate number of medallists for each type of school, and if one takes into account the number of pupils at these schools, it is clear that private and provincially subsidized private schools have fared better since there are fewer pupils attending these schools than provincial schools.

In respect of the schools attended by medallists it was found that the 164 medallists came from 79 different schools (i.e. 9,9 % of the total number of secondary schools for whites in the RSA). Of these 79 schools, 50 have produced only one medallist, 13 have produced two, etc. The school with the highest achievement has so far produced 12 medallists.

3.3.2 Standard 10 subjects and distinctions achieved

The analysis contained in this paragraph is based on the information received from 145 medallists. It appears that the average number of distinctions achieved per medallist was 4,1 (see Figure 8). The information also reveals that 99,3 % of the aforementioned medallists obtained distinctions in Mathematics, 93,1 % in Physical Science and Chemistry, and 35,9 % in Additional Mathematics. Hence it may be said that medallists distinguish themselves mainly in the field of the natural sciences (see Figure 9).

It should be noted that approximately 48 % of all medallists study Additional Mathematics as one of their Std 10 subjects, which could have resulted in those pupils' revealing much more advanced thought development than their fellow pupils who had had to make do with the normal number of periods for instruction in Mathematics.

FIGURE 8: NUMBER OF DISTINCTIONS PER MEDALLIST

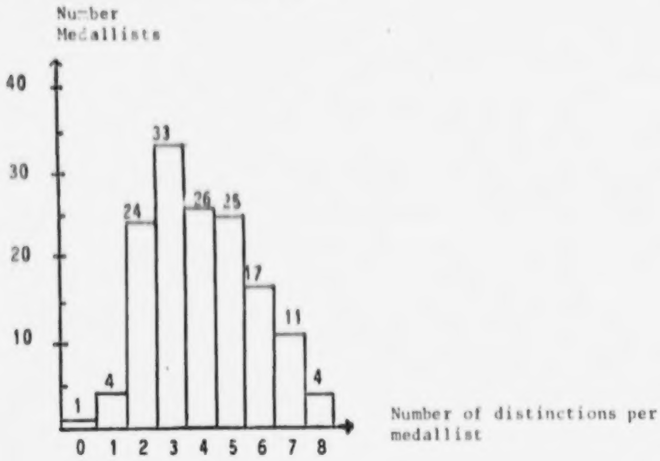
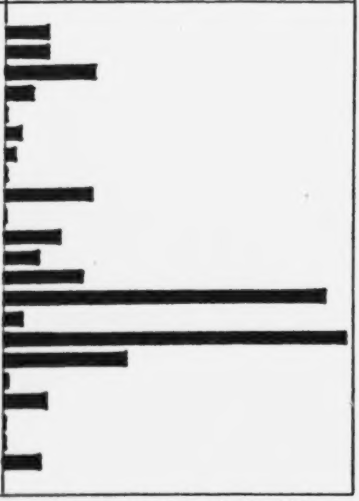


FIGURE 9: STANDARD 10 SUBJECTS AND THE PERCENTAGE OF MEDALLISTS THAT ACHIEVED DISTINCTIONS IN EACH

Subjects	%*
Afrikaans First Language HG	12,4
Afrikaans Second Language HG	12,4
English First Language HG	26,2
English Second Language HG	8,3
German Mother Tongue HG	0,7
German Third Language HG	4,8
French HG	3,5
Hebrew HG	0,7
Latin HG	26,2
Zulu SG	0,7
Geography HG	16,5
History HG	11,7
Biology HG	23,5
Physics and Chemistry HG	93,1
Mechanics HG	6,2
Mathematics HG	99,3
Additional Mathematics HG	35,9
Applied Mathematics HG	1,4
Computer Studies SG	12,4
Business Economics SG	0,7
Enonomics HG	0,7
Accountancy HG	10,4



*Percentage: The number of distinctions as a percentage of the 145 medallists from whom this information was obtained.

3.3.3 Special preparation for the Mathematics Olympiad

Of the 90 medallists from whom feedback in respect of their preparation for the Mathematics Olympiad was obtained, only slightly more than half (56,7) had prepared themselves specifically for the olympiad.

3.3.4 Mathematics clubs

The survey reveals that of those medallists from whom this information was obtained, 94,4 % were not members of Mathematics clubs. In the majority of cases no clubs of this nature existed at the schools they attended.

3.4 ACADEMIC TRAINING ON TERTIARY LEVEL

3.4.1 Fields of study

The data presented in this paragraph are based on information received from 126 medallists. The information reveals that at the time the questionnaire survey was conducted, 34,9 % of the medallists were enrolled at a tertiary institution for the first time and that at that stage 64,3 % had already obtained some tertiary qualification, which means that 99,2 % were either involved in tertiary education or had already received such training. Among the 126 medallists involved in the survey there was in fact only one who had not received any tertiary training.

Figure 10 shows the percentage of medallists in each qualification group. The fact that some medallists were qualified in two different fields and/or were enrolled for a further qualification explains why the total percentage is higher than 100. It was found that altogether 10,3 % of all medallists involved had also obtained a degree in a field other than that of their first degrees, for example B.Sc. and M.B.A.

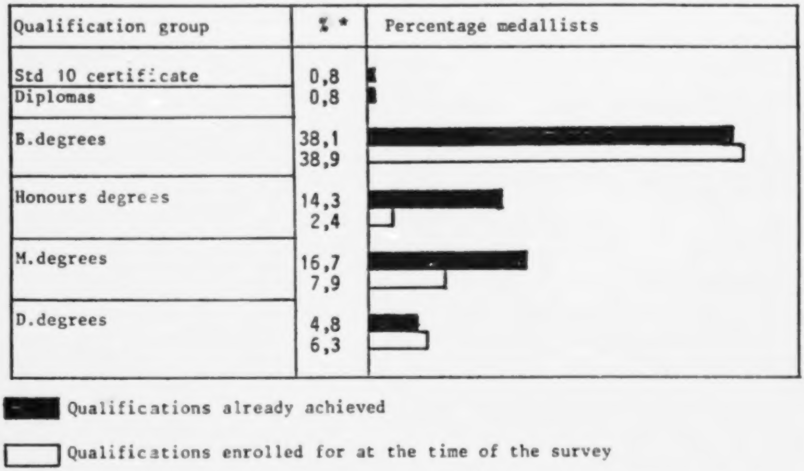
As can be seen in Figure 11, the majority of tertiary qualifications obtained by medallists involved study in purely scientific fields (48,9 %), with engineering taking the second place (23,4 %). Other qualification groups occur much less frequently. A comparison of the

232

courses already completed with those in which medallists were still enrolled at the time of the survey indicates two main changes - a decrease in respect of pure natural sciences (48,9 % to 35,7 %) and an increase in the study of medicine (7,4 % to 14,3 %). In respect of subject choice there was a notable decrease in the number of medallists studying Mathematics (45,6 % to 33,3 %), with an increase in the number opting for Computer Science.

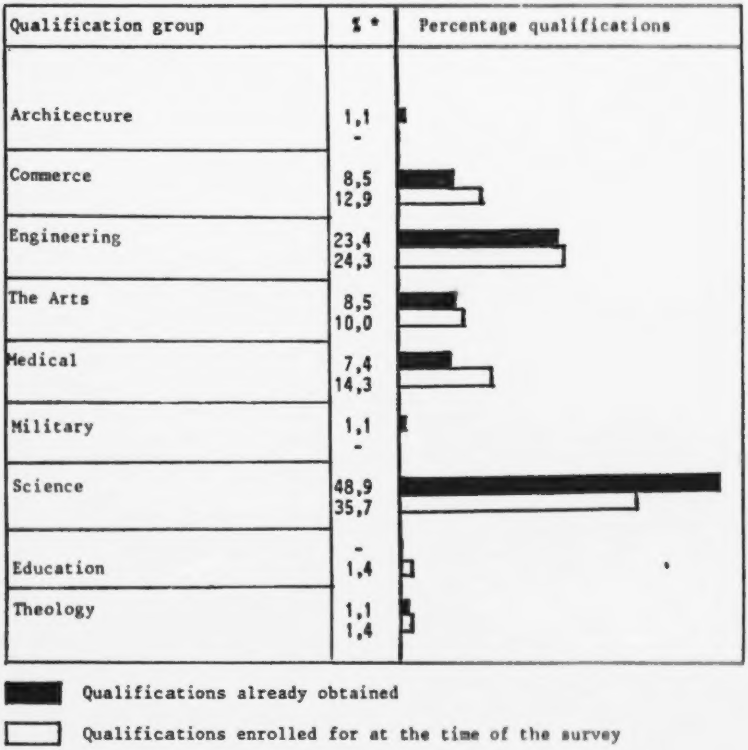
Also interesting to note is that of the 126 medallists involved in the survey, 22 (i.e. 17,5 %) obtained their degrees with distinction.

FIGURE 10: HIGHEST QUALIFICATIONS BY MEDALLISTS, OR FOR WHICH THEY ARE ENROLLED AT PRESENT



* The percentage represents the number of medallists that have achieved a particular qualification (or are enrolled for it) proportionate to the total number of medallists from whom information was received.

FIGURE 11: QUALIFICATIONS OF MEDALLISTS ACCORDING TO FIELD OF STUDY, INCLUDING THOSE FOR WHICH THEY ARE ENROLLED AT PRESENT



* The percentage represents the number of qualifications in a particular field in proportion to the total number of qualifications already obtained or the total number of courses which medallists are enrolled for.

3.5 GENERAL : CULTURE, SPORTS, HOBBIES

From Figure 12 it is evident that the majority of medallists had a varied field of interest. The large percentage who devoted time to cultural activities, sports and hobbies during their school years and afterwards indicates a balanced spending of time, which usually has a positive effect on academic achievement. Note that passive pastimes included those activities that did not require physical exertion, for example reading (30 % of the medallists), working on a computer (21 %), etc., whereas active pastimes included activities such as walking (5 %), woodwork (3 %), etc.

3.6 PROFESSIONS CHOSEN BY MEDALLISTS

Data on the professions chosen by medallists are based on information received from 118 medallists. The 53,4 % practising a full-time profession (46,6 % were enrolled as full-time students) were all involved in careers classified as "professional or semiprofessional". The largest single group (16,1 % of the 118 medallists) was engineers, with specialists employed in numerical fields (13,6 %) in second place (see Figure 13).

The majority (60 %) of medallists at present involved in pursuing a career was employed in the private sector.

4. FINDINGS

(1) As far as the profile of Mathematics Olympiad medallists as a group of mathematically gifted pupils is concerned, it has in a sense not always been possible to identify a particular system or order within this group of "stars", defined as being highly individualized. The picture that evolves (though not always too clearly), reveals the following:

- The medallists come from culturally and educationally supportive home and school environments.
- The identified mathematical giftedness of medallists finds expression in relatively conventional channels (career and otherwise):

FIGURE 12: CULTURE, SPORTS AND HOBBIES/PASTIMES MEDALLISTS' PARTICIPATION

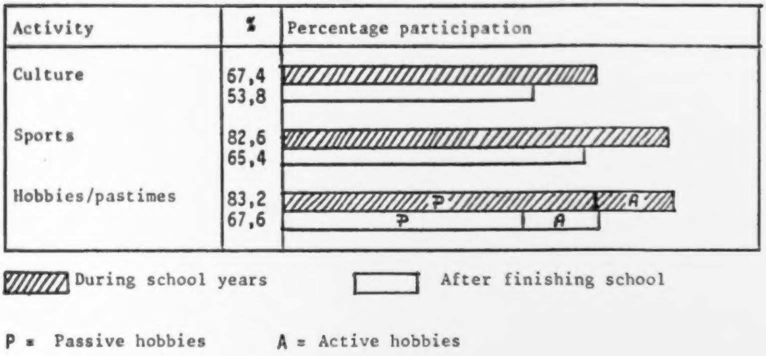
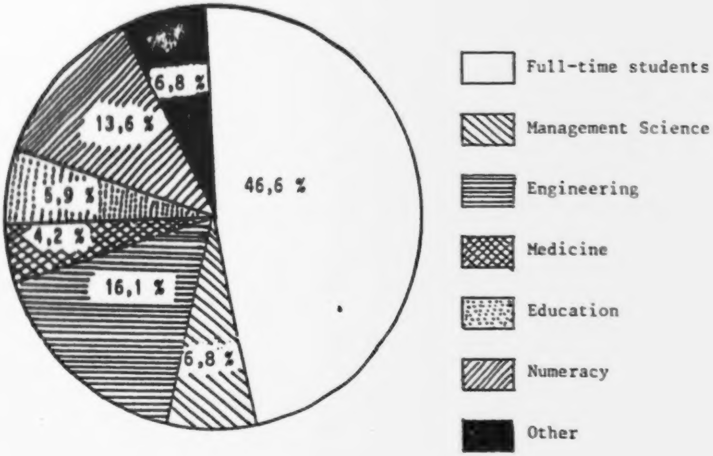


FIGURE 13: OCCUPATIONS OF MEDALLISTS



- More than 99 % of the medallists completed their tertiary education before entering the professional field.
- A significant majority choose a career in the fields of numeracy or the natural sciences. Engineering is particularly popular.

(2) With the introduction of the Mathematics Olympiad the Suid-Afrikaanse Akademie vir Wetenskap en Kuns certainly achieved a dual objective, namely:

(a) The creation of a mechanism for identifying pupils with a special gift in the field of mathematics, thus exerting a decisive influence on a number of the medallists' future plans.

(b) Providing the mathematically gifted pupil with a unique challenge, satisfying his need for such a special exercise.

5. RECOMMENDATIONS

The preceding study has resulted in the following recommendations:

(1) While the Mathematics Olympiad for senior pupils, arranged by the Suid-Afrikaanse Akademie vir Wetenskap en Kuns, has become a well-established annual event, the interest in this type of exercise has grown considerably, as is becoming evident from the number of other Mathematics olympiads/competitions that are being held throughout the country mainly for more junior pupils.

As far as the researcher could determine, the following regional Mathematics olimpiads/competitions exist at present:

(a) The University of Cape Town's School Mathematics Competition for Standard 6 to 10 pupils in the Western Cape.
(b) MASA's Mathematics Mini Olympiad for Western Cape pupils from standard 2 to 5.
(c) The Junior Mathematics Olympiad of the Eastern Cape for pupils in Standards 5 and 7.

(d) MASA's Mathematics Olympiad for Transvaal pupils in Standard 5.

(e) The Mini Mathematics Olympiad for Standard 6 to 8 pupils in the Transvaal.

(f) MATHFEST for Standard 5 pupils in Transvaal.

(g) MATHSKILL for Standard 5 pupils in Natal.

(h) MATHFEST for Standard 5 pupils in Natal.

(i) Mathematics seminars for secondary schools in Natal.

(j) Mathematics evenings for secondary school pupils in Durban and Pietermaritzburg.

(k) The Mathematics Olympiad for Standard 5 pupils in the OFS.

(l) The Mathematics competition for Standard 6 to 9 pupils in Bloemfontein and environs.

(m) The Orange Free State Mini Mathematics Olympiad for Standard 10 pupils.

Since these olympiads/competitions are arranged by the regional managers of the Mathematical Association of South Africa (MASA) and there is a general lack of co-ordination among the organizers, it is recommended that they meet biennially to discuss the approach to olympiads/competitions and other matters of interest. These discussions will not be aimed at organising the existing regional olympiads/competitions on a national level (the present type of organization being more favourable), but will serve mainly to give organizers an opportunity to consider the nature of the olympiads/competitions to ensure that, rather than becoming simply another school examination, they will continue to make a real contribution to mathematics instruction in the RSA. The biennial Congress for Mathematics Teachers organized by MASA offers the ideal opportunity for discussions of this nature.

(2) The question arises whether, apart from the personal satisfaction derived from their success, Mathematics Olympiad medallists should benefit in any other way. In Hungary, for instance, the top ten achievers in their Mathematics Olympiad are exempted from writing entrance examinations to universities and other institutions for tertiary education (Van Rooy 1973:4-15).

While it would be impossible to limit the offers and other privileges enjoyed by medallists as a direct result of their achievement in the Mathematics Olympiad, the general feeling is that it is unnecessary to consider the establishment of a *specific compensation scheme* for medallists. The introduction of such a scheme could in fact undermine the original purpose of the Olympiad - the inner satisfaction of a challenge well met should at all times take priority over external rewards.

(3) Serious thought should be given to the establishment of Mathematics clubs where active groups of interested pupils can meet regularly in a climate conducive to the development of their natural gifts. In Russia, for instance, a booklet containing preparatory problems is sent to all prospective candidates for the Mathematics Olympiad at the beginning of each year. In the course of the year the contents are studied by groups of enthusiasts belonging to Mathematics clubs or working together in mathematically oriented communities, so that the actual Olympiad becomes the climax of a year's intensive activity (HSRC 1971:2).

REFERENCES

DROST, A.W. *Aspekte van die klaskamerpraktyk in Natuur- en Skeikunde*. Pretoria : RGN,1980.

INTERNATIONAL MATHEMATICAL CONTESTS. *Science Education Newsletter* No. 44, Jan. 1981 : ss.

LYON, H.C. Realising our potential. In: GIBSON, Joy and CHENNELS, Prue (ed.) *Gifted children: looking to their future*. London : Latimer New Dimensions, 1976.

MALAN, A.P. Die Wiskunde-olimpiade: wat word daarmee beoog? *Spectrum*. 7(2), Junie 1969 : 117 en 136.

MALAN, A.P. Die Wiskunde-olimpiades. *Die Skoolblad The Teacher* 59(2), Feb. 1971 : 6-8.

PARKYN, G.W. The identification and evaluation of gifted children: a new perspective. In: GIBSON, Joy and CHENNELS, Prue (ed.) *Gifted children: looking to their future*. London : Latimer New Dimensions, 1976.

RAAD VIR GEESTESWETENSKAPLIKE NAVORSING. Instituut vir Opvoedkundige Navorsing. *Die Suid-Afrikaanse Wiskunde-olimpiade*. Pretoria : RGN, 1971(a).

RAAD VIR GEESTESWETENSKAPLIKE NAVORSING. Onderwysvoorsiening in die RSA: Verslag van die hoofkomitee van die RGN-ondersoek na die Onderwys. Pretoria : RGN, 1981.

RAAD VIR GEESTESWETENSKAPLIKE NAVORSING. Instituut vir Opvoedkundige Navorsing. Wiskundewedstryde in verskillende lande. Pretoria : RGN, 1971(b).

SUID-AFRIKA (Republiek). Departement van Statistiek. Onderwys Blankes. Pretoria : Staatsdrukker, 1966-1978.

SUID-AFRIKA (Republiek). Sentrale Statistiekdiens. Onderwys Blankes. Pretoria : Staatsdrukker, 1979.

SUID-AFRIKA (Republiek). Sentrale Statistiekdiens. Onderwysstatistieke Opsomming. Pretoria : Staatsdrukker, 1980-1983.

SUID-AFRIKAANSE AKADEMIE VIR WETENSKAP EN KUNS. Die Wiskunde-olimpiade vir 1970. Pretoria : 1971.

SUID-AFRIKAANSE AKADEMIE VIR WETENSKAP EN KUNS. Jaarverslae, 1966 tot 1983.

THE UNITED STATES GIFTED AND TALENTED CHILDREN'S EDUCATION ACT OF 1978. Artikel 901(b). In: NEETHLING, J.S. Onderwys vir die begaafde kind. s.l.: s.n., 1981.

TRANSVAALSE ONDERWYSDEPARTEMENT. Wêreldtendense in Wiskunde-onderrig soos gestel by die vierde internasionale kongres oor Wiskunde-onderwys (ICME) 1980. Streekkursus aangebied by die Onderwyskollege vir verdere opleiding (Mei 1982 : Pretoria).

VAN ROOY, A.J. Verslag oor die tweede internasionale kongres oor die onderwys van Wiskunde, Exeter, Engeland. Augustus-September 1972. Pretoria : RGN, 1973.

VISSER, JUDITH D. Geslagsverskille in deelname aan Wiskunde in Wiskundeprestasie. Pretoria : Universiteit van Suid-Afrika, 1985. (Ongepubliseerde D.Phil.-proefskrif)

WIDDUP, D. Women and Maths: a wasting of talent. Education News 17(6), 1981 : 22-25.

AN EMPIRICAL INVESTIGATION OF STUDENT LEARNING

D. L. HATTINGH

1. INTRODUCTION

When one considers the expense incurred in the education of students, it is in everyone's interest to gain a better understanding of and greater clarity in regard to student learning. A better understanding of what student learning involves may lead to students studying more effectively and lecturers teaching more effectively. Not only does this affect the taxpayer's pocket, but the students of today tend to become the leaders of the community tomorrow, and effective study methods at university will eventually influence the whole community.

Much has already been done to cast light on the phenomenon of learning, and studies on the functioning of the brain contribute indirectly to elucidating this phenomenon. In this connection the works of Das, Feuerstein and Sternberg may be mentioned. Sternberg has a triarchic theory of human intelligence that comprises three subtheories, namely the contextual, experiential and componential theories. The phenomenon of learning may go awry if the pupil is unable to encode information selectively, to compare and to relate or, for example, to automatize the processing of information (Kolligian and Sternberg 1987). These are matters that can be improved and the pupil or student can thus be helped to study more effectively. Feuerstein bases his theory on cognitive modifiability. According to him the cognitive ability of the pupil who is a poor academic achiever can be increased by mediated learning (adult intervention that focuses the pupil's attention on limited extracts from his culture). Feuerstein employs instrumental enrichment programmes to bring about structural cognitive change. The pupil then benefits more from direct formal and informal education. Feuerstein's work is related to the ideas of Marton and Entwistle which will be discussed later in this paper. The connection is to be found in Feuerstein's expectation that the pupil should be a generator of new information rather than a passive recipient of information (Feuerstein 1980). Das distinguishes between simultaneous and successive synthesis. Rote learning and serial recall of information are behaviours that are associated with successive synthesis, while reasoning falls under simultaneous synthesis. As will be seen later, there are points of contact with the theories of Marton, Pask and Entwistle.

Marton and Entwistle were selected for the task described in this article because very little has been written about them in South Africa and because their studies possibly present the most interesting research material. The reader should also be fully informed about Marton's philosophy because it contains the fundamental principles on which Entwistle's experiment is based as well as the experiments at the University of Pretoria described below.

The research reported in this article was an exploratory investigation which did not have generalizations as an objective. A further study might possibly consider how generalizable the findings are. The aim was to repeat the experiments of Entwistle and Marton to see whether the same findings were reached.

2. A NEW RESEARCH INITIATIVE

The research described here was modelled on the work done by Entwistle in Britain. He in turn was strongly influenced by Marton and his colleagues at the University of Gothenburg and by Pask. They produced a new research initiative in regard to the problem of student learning. In essence this initiative amounts to going to the student himself to determine how learning takes place in everyday situations. This breaks with the tradition of postulating sometimes far-fetched theories about learning and study that could be applied with difficulty to the everyday situation. Marton and his colleagues endeavoured to preserve the close relation between the results of research on learning and the practice of teaching (Cloete 1984: 65-69). Research should, according to them, be based on the daily experience of the student, not on the previously conceptualised theoretical framework of the researcher. The Gothenburg group also broke away from the traditional method of observing the external behaviour of learners. They let the students themselves report on their approaches to learning. Interviews were then studied repeatedly until the underlying basis of learning was arrived at. Critics argue that the result is obtained subjectively, but it can be pointed out that the strictest statistical method is also subject to human judgement. This applies, for example, when test items are compiled and again when findings are interpreted.

Marton and his group followed the path of phenomenological research in their investigations. Consequently the study of externally perceptible behaviour is not considered a criterion of objectivity. The emphasis falls rather on the personal observations of students about their own learning. The initiative of the Gothenburg group therefore to a significant extent amounts to what Cloete has to say about the social sciences: "The primary role of social science should be the reconstruction of the ways in which the agents themselves explain their action and the theoretical concepts used should not depart radically from those of the agents" (Cloete 1984: 67).

The emphasis has shifted from the lecturer as observer to the student's own view of the matter. In addition this research method differs from the traditional approach in that experiments were not done with the memorization of meaningless material (cf. Ebbinghaus, Neumann, etc.), but with the "understanding" of meaningful complicated reading matter. The latter approach avoids artificiality and is closer to the real-life situation. This also illustrates that learning is no longer defined in terms of memorization but in terms of the understanding of the reading matter presented.

The new research initiative can also be distinguished from the traditional approach by pointing out its qualitative instead of quantitative approach, or its aim of achieving an empathic comprehension of the student's experience rather than producing a predictive study. Entwistle points out that the great difference between the two approaches is a philosophical one. The quantitative method employs a reductionist approach and uses formal or mechanical models that assume series of causal connections. In contrast the alternative paradigm involves research approaches that have their foundation in phenomenology and make use of direct exploration of the learning experiences of students (Entwistle 1984: 13).

3. A DIFFERENCE IN THE INTERPRETATION OF THE OUTCOME OF LEARNING

A great difference between the traditional (quantitative) view of learning and the view of the Gothenburg group is that according to the latter view the outcome of learning should be seen not in quantitative but in qualitative terms. This means that the new approach no longer considers how much a student has learnt but what he has learnt. In their initial research Marton and his collegues at Gothenburg had already determined that there were differences in the outcomes of learning and that these differences were in fact qualitative. The prevailing opinion was queried, i.e. that learning was the collecting of elements of knowledge and was reflected in the degree of verbal correspondence between the student's answer and the information conveyed to him. According to Marton a pupil who gives many facts in his answer may be giving an answer of poorer quality than one who gives few facts but shows that he understands.

4. A DIFFERENCE IN THE INTERPRETATION OF KNOWLEDGE

From the preceding paragraph it could already be deduced that the Gothenburg group would introduce a new concept of knowledge. Knowledge is, according to them, not the quantity of facts known, but rather answers to "why" questions. Traditionally it has been possible to characterize knowledge as the quantitative and reproductive. Marton and his colleagues object to this, because this kind of knowledge requires neither understanding nor the ability to analyse. Linking up with what has been said above, the concept of "memory" now also undergoes a change. Memory is no longer regarded as a reproductive storage mechanism, but rather as the human potentiality to reconstruct meaning. The new view of memory is closely related to the view that knowledge is not discrete bits of content that the pupil reproduces verbatim, which in turn indicates that learning is not the mere intake of content. Learning, memory and knowledge are thus closely related.

244

5. THE CONCEPT OF THE "APPROACH TO LEARNING"

Marton and his supporters had a special reason for choosing the concept of the "approach to learning" instead of the concepts of strategy or process. According to them there is an exceptionally close relation between the student's idea of what learning is, which is largely going to determine how he approaches a learning task, and the eventual result of that task. "Approach to learning" therefore indicates the significance of both intent and organising principles for the outcome of learning.

Approach includes specifically both the intent (what the student was aiming for) and the process (how the intent was carried out). Marton and his colleagues wished to avoid the mechanistic tendency connoted by the term process.

6. MARTON'S CATEGORIES: DEEP-LEVEL APPROACH AND SURFACE-LEVEL APPROACH

The qualitative investigation of the learning process led Marton and his fellow workers to the conclusion that some learners learn purely by memorizing, while others try to understand what they learn. He termed the first method the surface-level approach and the second the deep-level approach. The chief difference in the learning processes of different learners is that some students focus on the text itself and others on that which the text contains, in other words on the writer's meaning, on the main argument or on the conclusion that can be drawn. With the deep-level approach the learner tries to find out the underlying meaning of the learning material he is studying. In the surface-level approach to learning the learner only wants to reproduce what he learns with a test or examination in view. The latter type of learning amounts in effect to a blind spasmodic attempt to memorise the text. In contrast the student who adopts the deep-level approach tries to understand the writer's message. The message is understood by looking at relations within the text, relations between the text and reality itself, or relations between the text and its underlying structure (Entwistle 1983: 16; Cloete 1984: 73).

Marton defines the two approaches as follows:

"In surface-level processing the subject focuses on the sign (i.e. the discourse itself or the recall of it)" (Marton and Säljö 1976a : 9). "Deep-level processing indicated that students had concentrated on what is signified (i.e. what the discourse is about)" (Marton and Säljö 1976a : 9).

Entwistle took over the idea of a deep-level and a surface-level approach from Marton, and called his two main categories meaning orientation and reproductive orientation.

7. PASK'S STYLES AND STRATEGIES OF LEARNING AND PATHOLOGIES OF LEARNING

Besides the ideas of Marton, Entwistle's work also links up with the contribution of Pask (Entwistle 1983: 23). An inventory for approaches to studying compiled by Entwistle was tested here in South Africa. The inventory contains questions based on Pask's theory. It is therefore necessary to discuss Pask's theory as well.

In England Pask identified two learning strategies that he termed the holist and the serialist learning strategies. Persons with a holist learning strategy adopt a global approach. A broad framework is built up first into which the detail is fitted in in due course. Persons with a serialist learning strategy, as the name indicates, learn the bits of detail step by step and only later arrive at a picture of the whole. The "holists" use analogies to relate aspects of a subject to one another and to the subject as a whole, while the "serialists" try to find logical connections linking the separate steps of which their learning consists. The holist seeks a wide variety of relationships between subjects, while the serialist concentrates on rules, methods and detail without initially knowing how they fit together (Ford 1985: 66; Cloete 1984: 73; Entwistle 1983: 23-25; Pask 1976: 133).

In regard to his two learning strategies Pask also distinguishes between two different styles of learning, namely comprehension learning and operation learning. He holds that the learning strategies are manifestations of more fundamental differences between students related to the manner in which they think. That is why students tend to adopt either a holist or a serialist approach. When a student shows a general tendency to use a particular strategy predominantly, this can be termed his learning style. The style that corresponds to a predominantly holist strategy is what Pask terms comprehension learning, and the style corresponding to a predominantly serialist strategy he calls operation learning (Pask 1976: 133; Entwistle 1983: 26). Comprehension learning involves "building descriptions of what is known" and operation learning "the fact of the learning process concerned with mastering procedural details" (Pask 1976: 133; Entwistle 1983: 26).

The two learning strategies identified by Pask each lead to a specific pathology of learning. The holist may lapse into "globetrotting" and the serialist into "improvidence". Globetrotting means that the student arrives at conclusions too rapidly. Pask describes the problem of globetrotting as follows:

"There are vacuous analogies where two or more topics are described and believed to have a systematic/formal principle in common, but do not actually have one" (Pask 1976: 140). This means that an inappropriate relation is made between two aspects of a subject. Improvidence in turn indicates that the student does not sufficiently relate the different bits of detail to one another and does not explain them. Pask draws the following comparison:

"Globetrotting may now be defined as the misunderstanding of valid analogies, the use of vacuous analogies or both, while improvidence is failure to use valid analogies, failure to use a common principle, or both" (Pask 1976: 140).

8. WORKING METHOD OF MARTON AND HIS COLLEAGUES

In the foregoing paragraphs the theoretical background to the research was briefly sketched. Because Marton's research has been repeated locally, his working method is briefly described here too. Marton and

247

his colleagues gave students articles to study. These were actual existing academic documents about 1 500 to 3 000 words long, and were not specially compiled for the experiment. Articles written in a fairly difficult style were selected. The students were told that they would be questioned on the articles they studied, but no indication was given of the kind of questions. After the students had studied an article, conversations were conducted with them in which they were asked general questions to see what they remembered of the article. General questions were followed by questions on certain parts of the article. The students were asked how they had approached the study of the article and what they had concentrated on.

The interviews were taped and the protocols typed verbatim. After this the protocols were studied to see whether there was a continuous relation between the different parts of a student's answer and whether in general there was something in common in the answers of all the students (cf. Entwistle 1983: 13-15). By reduction final categories were established that reflected the chief differences in the students' approaches to studying.

9. ENTWISTLE'S WORKING METHOD

Entwistle used findings that were obtained qualitatively in order to do quantitative research. Linking up with the ideas of the Gothenburg group and Pask he compiled a questionnaire that he titled the Approaches to Studying Inventory. This questionnaire contains questions that highlight the deep-level and surface-level approaches. Questions are also asked on the learning styles and learning pathologies of Pask.

In addition Entwistle wanted to see whether the different motivations such as intrinsic, extrinsic and achievement motivation were related to Marton's approach to learning. The affective life of the student was also involved through questions about fear of failure, negative attitudes to study and disorganised study methods. To determine the relationship between these factors, factor analysis was used. Entwistle's quantitative method enabled him to involve a much larger group of students (over 2 000) than was possible in the qualitative experiment of Marton and his colleagues. Entwistle was also able to involve students from more different fields of study than Marton and Säljö.

10. RESEARCH METHOD OF THE LOCAL INVESTIGATION

This research included both quantitative and qualitative data gathering and processing components. The quantitative component comprised the obtaining of information through questionnaires and the technical processing of the information by factor analysis. The qualitative component consisted of the qualitative analysis of the protocols of interviews with students. The qualitative research was done in accordance with the methods of Marton and Säljö and the quantitative research in accordance with those of Entwistle.

11. THE QUANTITATIVE LOCAL INVESTIGATION

Entwistle's questionnaire, Approaches to Studying, was translated into Afrikaans and answered by 392 students of the University of Pretoria (UP). The students were mainly fourth-year HED students at the Faculty of Education who had obtained B.Com., B.Sc., B.A. and B.Mus. degrees. Students answered the questionnaire in groups and there was no time limit.

12. A COMPARISON BETWEEN THE CORRELATION MATRICES OF ENTWISTLE'S AND UP STUDENTS

Comparison of Tables 1 and 2 shows that the results of the questionnaire obtained with the UP students correspond to a considerable extent with Entwistle's findings. Among both groups of students there is a common positive correlation of a comparable order between the subscales of meaning orientation. As regards the reproductive orientation there is also a positive correlation of comparable order between the subscales in both correlation matrices. In the correlation matrix of Entwistle's students as well as that of the UP students there is a comparable negative correlation between the subscales for meaning orientation and reproductive orientation. As expected also, the subscales "strategic approach", "achievement motivation" and "comprehension learning" in both correlation matrices show positive correlation with subscales of the dimension of meaning orientation. There is also justification for the distinction between the learning styles (comprehension learning and operation learning) and their respective pathologies (globetrotting and improvidence) as reflected in the generally greater number of negative signs in regard to the correlations of the pathology scores with the subscales of the dimension of meaning orientation.

The four subscales of reproduction orientation show a positive correlation with serialist learning (operation learning) and its pathology (improvidence) in both matrices, and also with the subscales "disorganized study methods" and "negative attitudes". It is interesting that "syllabus-boundness" and "fear of failure" do not correlate with "negative attitudes" as closely among UP students as among the students in Entwistle's experiment. Otherwise than one would expect, "extrinsic motivation" and "strategic approach" showed a positive correlation with one another in both matrices, as did "surface approach" and "achievement motivation", again in both correlation matrices. There is also a positive correlation in both matrices between "surface approach" and "extrinsic motivation" on the one hand, and "achievement motivation" on the other. According to Entwistle this does not fit into the framework (Entwistle 1983: 48), because achievement motivation actually goes with the deep-level approach. Entwistle points out that the two pathologies are reconcilable in practice, which is borne out by the positive correlation between the two subscales in both tables, although there is a negative correlation between the two styles of learning, also in both tables.

The two correlation matrices do, however, differ in that "comprehension learning" shows a positive correlation with "surface approach" and "extrinsic motivation" in Table 2, while the corresponding correlations in Table 1 are both negative. Both, according to expectations, ought to be negative. Each pathology correlates positively with the learning style of which it is a pathology, especially improvidence with operation learning. This in in accordance with Pask's theory.

TABLE 1

ENTWISTLE'S CORRELATION MATRIX OF TOTALS FOR THE SIXTEEN VARIABLES

	MEANING				REPRODUCTION				ACHIEVEMENT				STYLES AND PATHOLOGIES			
	DA	RI	UE	IM	SA	SB	FF	EM	ST	DS	NA	AM	CL	GT	OL	IP
Meaning orientation																
Deep approach		48	43	47	-09	-28	-05	-12	24	-22	-25	19	37	-03	06	-05
Relating ideas			40	39	-03	-22	03	-11	22	-10	-17	13	39	08	03	02
Use of evidence				36	-11	-15	-06	-03	21	-14	-22	20	24	-12	15	-01
Intrinsic motivation					-20	-37	-08	-35	17	-22	-41	16	37	-07	-07	-12
Reproducing orientation																
Surface approach						37	32	28	18	18	23	11	-09	24	29	42
Syllabus boundness							27	32	06	24	22	06	-28	11	37	35
Fear of failure								15	03	22	21	04	-01	19	22	39
Extrinsic motivation									16	07	13	20	-19	04	30	27
Achieving orientation																
Strategic approach										-20	-17	25	03	-09	24	12
Disorganized study methods											30	-10	06	24	-05	13
Negative attitudes to studying												-24	-02	25	-02	13
Achievement motivation													04	-02	19	08
Styles and pathologies																
Comprehension learning														18	-23	-12
Globetrotting															-07	19
Operation learning																41

Decimal commas omitted.

TABLE 2

CORRELATION MATRIX FOR UP STUDENTS OF TOTALS FOR THE SIXTEEN VARIABLES

	MEANING				REPRODUCTION				ACHIEVEMENT				STYLES AND PATHOLOGIES			
	DA	RI	UE	IM	SA	SB	FF	EM	ST	DS	NA	AM	CL	GT	OL	IP
Meaning orientation																
Deep approach		51	48	47	-06	-15	-13	00	35	-14	-11	19	30	-09	09	-05
Relating ideas			53	43	-08	-20	-19	-10	24	-14	-15	13	23	-13	03	-16
Use of evidence				40	-02	-17	-11	06	27	-13	-05	17	25	-13	05	-49
Intrinsic motivation					-15	-23	-16	-21	22	-23	-24	28	10	-17	03	-11
Reproducing orientation																
Surface approach						29	33	30	02	40	19	16	13	39	19	41
Syllabus boundness							27	16	-00	24	07	-12	-12	17	36	42
Fear of failure								11	-04	36	07	-01	-01	28	24	40
Extrinsic motivation									14	13	36	08	13	07	10	10
Achieving orientation																
Strategic approach										-13	-12	20	42	-08	16	04
Disorganized study methods											29	01	08	37	07	30
Negative attitudes to studying												-13	08	22	-11	05
Achievement motivation													17	06	17	14
Styles and pathologies																
Comprehension learning														14	-04	-03
Globetrotting															04	29
Operation learning																42

Decimal commas omitted.

13. FACTOR ANALYSIS: A COMPARISON OF ENTWISTLE'S RESULTS WITH THOSE OBTAINED WITH UP STUDENTS

A factor analysis was carried out on the intercorrelation matrix of the 16 subscales. The resulting factor matrix was subsequently compared to the corresponding factor matrix obtained by Entwistle. A principal factor analysis was carried out. Entwistle used the SPSS programme for his factor analysis, whereas the BMDP programme was used with regard to the data of the UP students. The number of students used in Entwistle's factor analysis, namely 2 208, is much larger than the 392 used for the UP experiment. The number of students used for the UP experiment is relatively small, but it should be borne in mind that the factor analysis was used only as an exploratory analysis in this investigation.

In order to compare the factor matrix obtained by Entwistle to that of the present investigation, the factor matrix of the UP students was obliquely rotated towards the target matrix (the factor matrix of Entwistle). Loadings below 0,25 were not available for the factor matrix of Entwistle and therefore the missing loadings were replaced by 9,00 for processing purposes.

The result shows that the square root of the mean squared deviations is equal to 0,086. This means that the factor loadings of the UP experiment differs on average with 0,086 from loadings obtained in the experiment of Entwistle. Seeing that a residual of 0,086 is small, it can be accepted that the factor matrices obtained from the two experiments are very similar to each other.

A comparison of the two factor structures in Tables 3 and 4 shows that there is a measure of agreement. Factor I in the factor analysis for UP students corresponds to Factor I in Entwistle's factor analysis. Factor III in Table 4 corresponds to Factor II in Table 3, and Factor II in Table 4 corresponds to Factor III in Table 3. Factor IV in the two tables shows no correspondence at all, however.

The first factor in both tables may possibly be termed meaning orientation and indicates meaningful learning. It may also be the deep-level approach, because the first three variables describe Marton's deep-level approach. Thus there is empirical support for Marton's theory. Entwistle is accordingly right when he asserts that meaningful learning is related to intrinsic and achievement motivation. Meaningful learning also has a stylistic component (compare the high loading on comprehension learning). This factor also presented no pathologies. Factor II in Tables 3 and 4 may be termed "reproduction learning". This factor also has a strong stylistic component. The fact that comprehension learning can be distinguished from operation learning likewise supports Pask's views. Factor III in Table 3 is characterised by Entwistle as "non-academic orientation". This factor has high loadings in regard to "disorganized study methods" and "negative attitudes to study". Factor IV can be described as "achievement orientation" in the case of both tables.

TABLE 3

FACTOR ANALYSIS (ENTWISTLE)

Variables	Factors			
	I	II	III	IV
Deep approach	70			(22)
Relating ideas	65			
Use of evidence	54			(23)
Intrinsic motivation	72		-25	
Surface approach		57	36	30
Syllabus boundness	-41	58		(24)
Fear of failure		50	34	
Extrinsic motivation	-25	58		53
Strategic approach	29			48
Disorganized study methods	-25		50	
Negative attitudes to studying	-39		52	
Achievement motivation	(24)			45
Comprehension learning	55	(-24)	30	
Globetrotting		62	52	
Operation learning				44
Improvidence		68	(24)	26

Decimal commas and most loadings below 0,25 omitted.

TABLE 4

FACTOR ANALYSIS (UP STUDENTS)

Variables	**Factors**			
	I	II	III	IV
Deep approach	73			62
Relating ideas	69			44
Use of evidence	60			56
Intrinsic motivation	67		-28	39
Surface approach		68	46	
Syllabus boundness	-39	55		
Fear of failure		57		
Extrinsic motivation	-37		54	67
Strategic approach	39			55
Disorganised study methods		51	50	
Negative attitudes to studying			54	39
Achievement motivation	27	29		
Comprehension learning	42		31	32
Globetrotting		47	46	
Operation learning		63	-26	48
Improvidence		81		

Decimal commas and most loadings below 0,25 omitted.

14. A SUMMARY OF THE FINDINGS OF THE QUANTITATIVE METHOD

The results of the quantitative method have supported the theories of Marton and Pask in the sense that the "deep approach" or "meaningful learning" and the "surface approach" or "reproduction learning" can be distinguished - and the same goes for the learning styles and pathologies of Pask. The result yielded by the qualitative research will be considered next.

15. QUALITATIVE RESEARCH WITH UP STUDENTS

The working method of Marton and Säljö was followed in the local experiment. Some of the students were required to learn the third chapter of The world educational crisis by P.H. Coombs (1968). Individual interviews were conducted with the students in which they were asked questions about the contents and their manner of learning. Conversations were taped and then written down. Sixteen B.Ed. students at UP took part in the experiment. A few of their answers will be discussed in the following paragraph.

16. STUDENT ANSWERS TO THE QUESTION ON HOW THEY LEARNT THE GIVEN TEXT

In the qualitative research, support can also be found for Marton's distinction between deep-level and surface-level approaches. In the first quote it is apparent that the student, when he learns, wants to find out what the writer's message is.

"I start reading it again and now try to bear the headings in mind and I try to understand what he wants to do, what he's actually ... what he's telling me now." (Translation)

The following extract also substantiates Marton's ideas and indicates almost specifically the difference between surface-level and deep-level learning.

"So, I won't say just a diagram, but I first wanted to get a global impression and then the thing ... I didn't altogether learn detail. I wouldn't go and learn figures, that isn't important to me. To me it's more a matter of what the man is wanting to say in the article ... You don't only have to know it, you have to know what it means. I never have time for anything very detailed. I think it's - yes it is - it's asking something of you, because it doesn't do any good if you take a piece and learn it passively off by heart. You still don't know what's in it, you're just reproducing what it says, but you aren't adding your own meaning to it. I think you have to know what you're learning." (Translation)

These two extracts will suffice. Students have shown that in their view learning is not simply the memorizing of facts. Marton's categories can thus be rediscovered in practice.

17. QUALITATIVE DIFFERENCES BETWEEN STUDENT ANSWERS TO QUESTIONS ON THE CONTENT

An analysis of the answers to questions on the content did indeed prove that there are qualitative differences between the answers of students. Most of the answers can be classified as A, B or C level answers. A level answers clearly reflected the writer's meaning. The B level answers were more oriented to conclusions, and C level answers usually only mentioned the problem being discussed. Marton's theory that students' answers differ qualitatively was once again proved right.

18. SIGNIFICANCE OF THE RESEARCH

Marton and his colleagues were also able to show that a deep-level approach to learning is related to academic achievement. Therefore it seems obvious that students should be encouraged to adopt a deep-level approach in their studies. Research has however shown that it does not help to make students learn in a particular way. The research done cannot in any case suggest a set of rules or a recipe for learning. As Entwistle says:

"The increased use of study skills programmes concentrating solely on techniques, rather than on the development of abilities to structure material with the aim of understanding, would be worse than useless" (Entwistle 1983: 207).

To get students to learn with the aim of understanding, it is necessary to make them aware of strategies and styles of learning. Each student must find the style of learning that best suits his or her personality and intellect and at the same time must learn to overcome the limitations of a particular style of learning. The improvident serialist needs help in practising the skills of developing ideas and analogies. The globetrotting holist should get practice in handling detail (Entwistle 1983: 208). All students require further orientation in regard to meaningful learning and reproduction learning. It is of course also important for pupils to be intrinsically motivated. Interest and relevance generally improve intrinsic motivation. In contrast an impending examination will tend to produce a surface-level approach.

19. SUMMARY

This document attempted to describe Marton's philosophy as well as to explain his categories of deep-level and surface-level approaches. The experiments of Marton and Entwistle were repeated and compared. A definite correspondence was discovered which indicates that further investigation is justified. The local research also showed the value of Entwistle's work. An attempt was made to point out the importance of identifying and expanding on the approach to learning.

REFERENCES

BIGGS, J.B. Faculty patterns in study behaviour. *Australian Journal of Psychology* 22(2), August 1970 : 161-174.

BIGGS, J.B. Study behaviour and performance in objective and essay formats. *Australian Journal of Education* 17(2), June 1973 : 157-167.

BIGGS, J.B. Dimensions of study behaviour: Another look at ATI. *British Journal of Educational Psychology* 46(1), February 1976 : 68-80.

BIGGS, J.B. The role of metalearning in study processes. *British Journal of Educational Psychology* 55(3), November 1985 : 185-212.

CLOETE, N. Perspectives on student learning: Has the long awaited paradigm-shift occurred? *Perspectives in Education* 8(2), December 1984 : 63-79.

COLAIZZI, P.F. *Reflection and research in psychology: A phenomenological study of learning*. Dubuque : Kendall/Hunt, 1973.

COOMBS, P.H. *The world educational crisis*. London : Oxford University Press, 1968.

DAHLGREN, L. Outcomes of learning. In: MARTON, F. *et al*. *The experience of learning*. Edinburgh : Scottish Academic Press, 1984.

ENTWISTLE, N.J. Contrasting perspectives on learning. In: MARTON, F. *et al*. *The experience of learning*. Edinburgh : Scottish Academic Press, 1984.

ENTWISTLE, N.J. *Styles of learning and teaching: An integrative outline of educational psychology*. Chichester : Wiley, 1981.

ENTWISTLE, N.J., RAMSDEN, P. *Understanding student learning*. New York : Nichols, 1983.

FEUERSTEIN, R. *Instrumental Enrichment*. Glenview : Scott, Foresman and Company, 1980.

FORD, N. Learning styles and strategies of postgraduate students. *British Journal of Educational Technology* 16(1), January 1985 : 65-77.

FRANSSON, A. On qualitative differences in learning. IV-Effects of motivation and test anxiety on process and outcome. *British Journal of Educational Psychology* 47(3), November 1977 : 244-257.

GOLDMAN, R.D. Effects of a logical versus a mnemonic learning strategy on performance in two undergraduate psychology classes. *Journal of Educational Psychology* 63(4), 1972 : 347-352.

KOLLIGIAN J., STERNBERG, R.J. Intelligence, information processing and specific learning disabilities: A triarchic synthesis. *Journal of learning disabilities* 20(1), 1987 : 8-17.

MARTON, F., HOUNSELL, D., ENTWISTLE, N. The experience of learning. Edinburgh : Scottish Academic Press, 1984.

MARTON, F., SäLJö, R. On qualitative differences in learning I - Outcome and process. British Journal of Educational Psychology 46(1), February 1976 : 4-11.

MARTON, F., SäLJö, R. 1976b. Learning processes and strategies. II - On qualitative differences in learning. Outcome as a function of the learner's conception of the task. British Journal of Educational Psychology 46(2), June : 115-127.

MARTON, F., SäLJö, R. Approaches to learning. In: MARTON, F. et al. The experience of learning. Edinburgh : Scottish Academic Press, 1984.

MOLLOY, G.N., DAS, J.P. Intellectual abilities and processes : An exploratory study with implications for person-teaching method interactions. The Australian Journal of Education 23(1), 1979 : 83-92.

PASK, G. Styles and strategies of learning. British Journal of Educational Psychology 46(2), June, 1976 : 128-148.

PASK, G. et al. Third progress report on SSRC research programme. Richmond : System Research, 1977.

SäLJö, R. Qualitative differences in learning as a function of the learner's conception of the task. Acta Universitatis Gothoburgensis, 1975.

SäLJö, R. Learning approach and outcome: Some empirical observations. Instructional Science 10, 1981 : 47-65.

SONNEKUS, M.C.H., FERREIRA, G.V. Die psigiese lewe van die kind-in-opvoeding. Stellenbosch : UUB, 1979.

AN OUTLINE OF THE RESEARCH ACTIVITIES OF THE DIVISIONS IN THE INSTITUTE FOR EDUCATIONAL RESEARCH

THE HSRC EDUCATION RESEARCH PROGRAMME

The HSRC Education Research Programme is a continuation of the Investigation into Education that was undertaken by the HSRC during 1980/81 at cabinet request. When the investigation came to an end, it was decided that there was a need for continuing research on certain issues and recommendations contained in the report, as well as research on new priorities that may come to the fore. As in the first phase of the investigation, this ongoing research programme is also undertaken under the auspices of the Main Committee (chaired by Prof. J.P. de Lange) and it is based on research partnership. This means that expert researchers who are attached to universities, other educational institutions and organizations are enlisted to do research as individuals or as members of a research team.

Excellent co-operation with universities, technikons, technical colleges, schools, government departments and private institutions resulted in the involvement of thousands of individuals in the research programme, rendering their services as members of committees or by doing research on request. The following research programmes have already been completed:

- Computers in education and training
- Utilization of educational radio and television
- Training of artisans
- Education for gifted pupils
- African languages in primary schools for whites
- Education for the black disabled
- Distance education
- Accreditation in the RSA
- Copyright and education and training
- Teacher training (with particular reference to black education)
- The provision of education for pupils in the non-formal education sector during the phase of compulsory learning

Other research themes that are currently receiving attention are skills training; training and job placement of disabled persons; education in a multicultural society and several other *ad hoc* projects.

It is the aim of the HSRC Education Research Programme to contribute towards better understanding and the handling of problematic matters concerning education, particularly by means of decision-oriented research. In order to achieve this purpose, it is necessary from time to time to gather information that will help to ascertain research priorities in a meaningful way. New research programmes planned for the near future are the following: An investigation into the expectations and perceptions of South Africans regarding education; research on the curriculum for History and an investigation aimed at clarifying the role and place of political conceptions in education.

DIVISION FOR EDUCATIONAL DEVELOPMENT STUDIES

This division undertakes, or initiates of its own accord, research concerning new developments in the field of education. The aim of the research is to evaluate existing strategies or to find or develop new strategies that may be implemented in the pursuit of change.

The division is currently involved in evaluative research on the careers education programme of the Department of Education and Training. A research project concerning the teaching of History as a school subject in the RSA is also to be initiated. Gaining credible information on attitudes of black educational leaders towards certain sociopolitical matters is also a research priority for this division.

DIVISION FOR EDUCATION STATISTICS RESEARCH

The mission of this division is to collect, to process, to computerize and to publish relevant and recent statistics and information on education in the RSA. The division is also responsible for planning and developing data bases for education that contain uniform and comparable data, for use in educational research and in planning.

In order to attain its goals, the division obtains education and population statistics from primary and from secondary sources. After the information has been edited as far as possible, it is captured in data bases. These data bases are planned and developed in such a way that relevant and the most recent education data can be made available economically for the purposes of sampling, analyses and the prediction of future trends by means of statistical inferences and projection techniques used in research and planning programmes. These education data are also used in computer programmes for the compilation of research reports, bulletins and brochures. Numerous requests for information are received from researchers of the HSRC, universities, other research councils, departments of education and other government departments as well as from the private sector.

The following research programmes and education data bases are currently functioning:

- Graduation trends
- Comparative education statistics
- Register of schools

Research on results in the final examination for Standard 10 as well as on the structure and proper functioning of an accountable data base for education statistics will be undertaken in the near future.

262

DIVISION FOR SPECIAL EDUCATION RESEARCH

This division is responsible for research, aimed at the improvement of school practice in the field of special education. Problem areas in education in general are also investigated by the division for special education research. It is also an aim of the division to contribute towards research methodology in the field of research in special education. The research on special education and that relating to special education projects are undertaken by the division on its own initiative or on a contract basis.

Examples of research projects undertaken by the division are the following:

- A suitable policy regarding a medium of instruction to be followed in SWA/Namibia
- Matters in connection with school hostels in SWA/Namibia
- A survey of disabled persons in SWA/Namibia
- An evaluation of the effect of a school readiness programme on the scholastic achievement of pupils at the junior primary school level in SWA/Namibia
- The effect of preschool education on the achievement of pupils at the junior primary school level.

DIVISION FOR RESEARCH INTO READING AND LEARNING REMEDIATION

This division undertakes research on the learning problems of learning disabled pupils and poor academic achievers of all population groups in the RSA. Remedial programmes for the improvement of reading and learning are also developed by members of the division in order to help these pupils realize their learning potential to the optimum.

The following are particular functions of the division:

- Research on learning and educational problems is undertaken, co-ordinated and promoted by the division
- Compensatory and remedial educational programmes are developed
- Guidelines are developed for use by teachers to identify and analyse poor academic achievement
- Theoretical and methodological contributions are made in the particular area of research
- The division also runs a reading laboratory for practical remediation of reading problems

The division is currently involved in a number of research projects, such as the development of the Abba programme (an Afrikaans reading programme for beginning and remedial reading), an analysis of reading objectives relevant to developing a remedial reading course for Afrikaans-speaking pupils in Standards 5 to 8, an Afrikaans course in advanced reading techniques for Standard 7 pupils in SWA/Namibia as well as investigations into the growth in reading proficiency as a result of the involvement of the READ organization in eight secondary schools in the Orange Free State, the use of the microcomputer in the teaching of reading and the remediation of reading problems, and the procedures for diagnosis and intervention with regard to children with learning problems, with particular emphasis on the neuropsychological factor.

DIVISION FOR COMPUTERS IN EDUCATION

The aim of this division is to promote the use of computers in all the spheres and at all levels of education and training in the RSA. Courses in computer utilisation are offered at a fee in fully equipped and modern laboratories to the general public and to interested parties in the field of education. Two computer laboratories are in use at this stage, namely a laboratory containing a complete TOAM system used for computer-assisted drill and practice in Mathematics, and a laboratory equipped with microcomputers in which users are trained to handle utility programmes such as word processing packages and spread sheets. Apart from the training of teachers, remedial teaching in Arithmetic, Mathematics as well as in Afrikaans and English, as second languages, is also available in both laboratories. Continuing research is also undertaken, *inter alia* to try to ascertain the relative effectiveness of different strategies of computer implementation.

DIVISION FOR EDUCATIONAL MEDIA RESEARCH

Through its basic research activities, the division endeavours to make a scientific contribution towards the existing field of knowledge regarding educational media and appropriate fields of research as well as the development of suitable research methods in this area of research. This theoretical knowledge is applied in practice so that expert knowledge regarding the establishment, conducting and evaluating of a workable system incorporating educational media can be extended and so that consultation work, a limited amount of programme development as well as evaluative research can be undertaken.

Currently, the main thrust of the research being undertaken on request, is towards evaluative research. Suitable strategies for media implementation as well as the training of teachers in the effective utilization of media in the classroom situation have also been investigated in the course of research projects. The evaluation of software and suitable implementation strategies for educational media such as the computer, the slide sound projector and the radio are examples of matters investigated in current or recently completed research projects. These projects are mainly undertaken at the request of individuals and institutions outside the HSRC and many of these are done on a contract basis. A data bank containing criteria for evaluation, arising from the research done by the division, may also be established.

DIVISIONS FOR CURRICULUM RESEARCH AND DEVELOPMENT:

- **NATURAL SCIENCES AND MATHEMATICS**
- **LANGUAGES**

The mission of the two divisions is to contribute towards the quality of teaching in the formal educational sector of the RSA in such a way that all parties concerned will benefit. This goal is pursued by the divisions through the study of, research on the development of and the dissemination of information regarding the curricula of the school subjects under consideration, mainly at the secondary school level. This research may be undertaken on own initiative, at the request of parties outside the HSRC or on a contract basis.

Several matters concerning the curriculum or curriculum related issues are currently being investigated by the two divisions.

The division for natural science subjects and Mathematics are involved in projects such as

- an independent study, and the possible implications of a modular approach to the curriculum of the school subject Physical Science;
- case studies of top achievers in the South African Mathematics and Science Olimpiads respectively;
- a survey and evaluation of organized activities in the RSA that enable young people, outside the formal school system, to get involved in independent "hands on" learning experiences in the realm of the natural science subjects.

Research projects undertaken by the division for languages are the following:

- The place, stature and role of Afrikaans as school subject in schools of the Department of Education and Training
- An evaluation of the grammar component in teaching Afrikaans and English as second languages on the primary as well as on the secondary school level
- The standard of linguistic proficiency required by employers from matriculants entering the job situation

Owing to the nature of their work, members of the two divisions concentrate on the following matters in theory and in practice:

- The curriculum in general
- Curriculum evaluation in general and in particular with reference to curricula of the subjects concerned
- Empirical investigations into all aspects of the curriculum and in particular the teaching of the subjects concerned
- The development of curricula and related matters in the subjects concerned, whenever it is requested
- The dissemination of information on the formal curriculum in general, and in particular on the subjects concerned

The division for natural science subjects and Mathematics is compiling a data base containing the names and particulars of persons involved in curriculum research and development at all levels of formal and non-formal education. The idea is eventually to make available a register containing the names and activities of these persons to all interested parties.

DIVISION FOR CURRICULUM RESEARCH AND DEVELOPMENT:

- **PREBASIC AND BASIC EDUCATION**

The mission of this newly reconstituted division is to focus on aspects of educational and psychological development in young children of the less privileged communities of South Africa. The particular interest here lies in developing more effective forms of preschool care and enrichment that will better equip such children for their early years in primary school.

At this early stage, the division will function as a data-collecting team. This function is a direct response to the dearth of scientifically-collected information that we have on South African preschool children. The basic assumption that underlies work done in this division, is that progress can only be made on the basis of factual information on how underprivileged children are reared in their everyday world, the degree of cognitive challenge that exists in their homes, the quality and quantity of social interaction such children are exposed to, etc. Once such data have been collected and analysed, the division will use it to plan and implement what is hoped will be effective preschool enrichment schemes.

Perhaps the unique attribute of this division is its methodological orientation. Since the research will obviously be multicultural in content, it is essential that culture-fair methods are used to assess children. In this regard, the division will concentrate almost exclusively on naturalistic techniques of data collection, which are renowned for overcoming much of the bias that exists in experimental or phenomenological approaches to cross-cultural work such as this. The team is perhaps uniquely equipped to conduct work of this nature, with all members of the division being highly experienced in naturalistic techniques of data collection.

The research currently being planned will cover a wide range of children in both rural and urban areas, and it is anticipated that the first results of the work will be available by April 1990.

DIVISION FOR CURRICULUM RESEARCH AND DEVELOPMENT:

* NON-FORMAL EDUCATION

The research undertaken by this division is mainly on education and training that takes place in the non-formal educational sector, i.e. outside the formal school situation. In most cases, the groups for whom curricula are provided in this sector, are adults in the workplace. If one takes into account the vast diversity between different work situations in which training can take place, it is clear that curriculum development takes place in unique situations and with unique aims or goals in mind.

Two main kinds of research are undertaken by the division. In the first place, the division tries to develop a theory of curriculum development in the non-formal educational sector. This theory must then be applied in practice so that curricula that are in line with prestated goals and aims can be developed and evaluated by also taking into account matters that were brought to the fore in a situation analysis and when ascertaining needs within a particular organization. In the second place, the division also aims to develop strategies for the development of curricula and co-ordinating actions so that training courses used in commerce and industry at this stage, can be evaluated and compared with each other. It is hoped that such a co-ordinating function will result in the rationalising of such courses, in that unnecessarily duplicated courses will come to light, similar courses offered by different institutions will be compared so that institutions will eventually accredit courses offered at training institutions other than their own.

The research undertaken by the division is mostly practically oriented. Whenever possible, researchers from the HSRC and experts attached to the institution requesting research, work together as research partners. Research units at other councils and at universities are also involved in research partnerships with this division.

Examples of research projects already undertaken by this division are a research project on the provision of education to prisoners in the RSA, a project that investigated possible training scenarios for all South African Fire Services and a project investigating matters influencing the development of training programmes in the private sector.

The division is considering the possibility of creating and maintaining a data bank containing information on (non-formal) training programmes offered in the Southern African region.

Report 0-267 (Available in Afrikaans only) 1985

Die identifisering en analisering van probleme wat kinders in die juniorprimêreskoolfase met die spelling van Afrikaans as eerste taal ondervind.

(The identification and analysis of problems with spelling in Afrikaans experienced by Afrikaans-speaking children in the junior primary school phase.)

A. DEDHAM
A.C. BOUWER

The successful mastery of the written language is nowadays regarded as essential for holding one's own in a technological society. The degree of literacy attained by a person is also reflected in how accurately he is able to write and spell.

Spelling is taught from the first year at school. Some pupils experience spelling difficulties even in the junior primary school phase, and without the necessary remedial aid this could lead to learning problems in most subjects.

It is extremely important that spelling difficulties be eliminated as far as possible in the junior primary school phase. The successful elimination of these difficulties largely depends on the correct analysis of each specific problem.

In order to analyse spelling difficulties successfully, it is necessary to know the various ways in which dysfunctions can occur in the dynamics of spelling education.

Spelling difficulties can arise when any one or more of the three components of the dynamics of spelling education are in disharmony with the other components. The problems pertaining to the three components are the following:

- *Inadequate teacher participation* owing to his poor preparation and planning, and/or to poor teaching during the lesson itself
- *Inadequate pupil participation* owing to learning deficiencies, and/or as a result of underachievement when the child fails to fully realize his potential
- *Content problems* arising from specific spelling structures (the orthography of the language), and/or from the fact that the pupil is in a developmental sense not yet ready to learn specific content

The way in which the components of spelling education can operate disharmoniously, is presented with the aid of a schematic presentation. The disharmonic effect of the various components on each other is indicated.

The analysis model for spelling difficulties constructed during this research is based on the findings regarding the dynamics of disharmonic education. The model serves as a guideline for the teacher's practice in the mainstream classroom. It emphasizes the necessity for a detailed analysis of all aspects of the three components of the dynamics of spelling education, so that the causes of a particular pupil's spelling difficulties can be determined within their unique context.

Report O-284 (Available in Afrikaans only) 1985

Die posisie van st. 5-leerlinge in die gedifferensieerde onderwysstelsel van SWA

(The position of Std 5 pupils in the differentiated educational system of SWA)

G.D. KAMPER

The policy of differentiated education, which has been applied in the RSA since 1971 and in SWA since 1974, stipulates that Standards 5, 6 and 7 form the junior secondary school phase. Accordingly, Std 5 pupils in SWA were gradually placed in secondary schools until in 1983 all White Std 5 pupils in SWA were accommodated in secondary schools.

Since 1983 the Directorate Education in the Administration for Whites in SWA has received several requests to reconsider the placement of Std 5 pupils in secondary schools. Consequently, the Institute for Educational Research of the Human Sciences Research Council was requested to investigate the position of Std 5 pupils in a system of differentiated education with special reference to local circumstances in SWA. The research was undertaken in collaboration with a research committee, representative of all parties concerned.

The research method made provision for

* a literature study on the theoretical bases of differentiated education, with special reference to Std 5 pupils;
* meetings with representatives of parties concerned in selected centres in SWA, during which evidence was given and/or memoranda presented on the school placement of Std 5 pupils, and
* questionnaires for completion by principals and school committees of primary and secondary schools.

The main findings of the research can be summarized briefly as follows:

- Std 5 pupils are in a sensitive transitional phase of their lives.
- The majority of parents and principals involved in primary schools do not regard the Std 5 pupil as emotionally and socially ready for the milieu of the secondary school.
- Std 5 pupils have no difficulty in coping with the educational standards of secondary schools and academic achievements are generally good. It can therefore be concluded that the milieu of the secondary school does not have a disruptive effect on the majority of Std 5 pupils.
- The maintenance of educational standards should be regarded as a cornerstone of any school placement policy. With reference to the existing infrastructure in secondary schools and the logistical circumstances in SWA, the placement of Std 5 pupils in primary schools and especially in smaller primary schools (with combined classes) could endanger the ability to cope with educational standards.
- Attainment of the objectives of differentiated education with regard to Std 5 pupils solely on the extent to which the educational and school programmes provide for the special needs of Std 5 pupils in order to create a school milieu which is cognitively challenging and affectively supportive. If circumstances which at present have a detrimental effect on the adaptation of Std 5 pupils in secondary schools are effectively dealt with, the secondary schools of SWA are in a position to create a challenging and supportive school milieu for Std 5 pupils, and they therefore should remain placed there.

Report O-287 (Available in Afrikaans only) **1986**

Riglyne vir kurrikulumontwikkeling

(Guidelines for curriculum development)

J.M. MOSTERT (Editor)

The **aim** of the investigation was to establish guidelines for curriculum development in order to contribute to the development and expansion of a comprehensive curriculum theory for the RSA.

The **method** used was an analytical study of local and overseas literature as well as the editing of research reports, including contract research reports and work documents of several specialists.

With regard to the **scope** of the study, emphasis was placed on

* situation analysis/needs assessment as prerequisite for the formulation of aims

* the selection and organizing of content

* the place of didactic guidelines in curricula

* experimental testing and implementation

* curriculum evaluation.

The most important **conclusions** arrived at on the grounds of which a number of recommendations were made, are the following:

* All curriculum bodies should make an effort to work as scientifically as possible and assist in the development of a sound theory for curriculum research and development in the RSA.

274

- Research indicates that the development of curricula, whether for formal or non-formal education, may be more scientifically accomplished if use is made of the proposed model (Figure 2.1). The degree of detail and sophistication of the various curricula should be determined by the particular situations.

- The model clearly indicates that curriculum development is a cyclic process. After curricula have been implemented and summatively evaluated, feedback should be provided which would result in further research.

Report O-290 (Also available in Afrikaans) 1986

Comparative education statistics
Part I: Population statistics for educational planning and the provision of education

J.J. BEZUIDENHOUT
Translated by: Isabel Claassen

The HSRC Investigation into Education of 1980 accented strongly the need for and the importance of available statistics on population, education and the financing of education and this gave direct rise to the introduction of a new research project on **comparative education statistics**. The outcome of the HSRC Education Report was the release of the **White Paper on the Provision of Education in the Republic of South Africa 1983** in which the Government consequently committed itself to eliminating backlogs that had been identified in the field of education and creating equal educational opportunities for all the country's inhabitants.

The granting of independence to Transkei in 1976, Bophuthatswana, Venda, and Ciskei in 1977, 1979 and 1981 respectively led to official publications of the Central Statistical Services excluding the population statistics of blacks in these republics. Consequently the information on blacks in the 1980 census survey differs markedly from the data obtained from previous censuses and naturally cannot be compared with the statistics of former years. In order to make comparisons possible between the population censuses for different years, information from the various independent states was also taken into account and the term Southern Africa used when the information was added to that of the RSA.

The mean annual percentage increases and the compound annual growth rate of the four population groups of Southern Africa for the period 1904 to 1980 were 4,03 % and 1,86 %; 6,44 % and 2,36 %; 7,52 % and 2,54 %; 6,56 % and 2,38 % for whites, coloureds, Asians and blacks respectively. As far as the percentage composition of the different population groups in the total population is concerned, the percentage for whites dropped by almost 6 %, while those for coloureds and Asians respectively increased by approximately 0,5 % and the figure for blacks by almost 5 % over the same period.

According to the population statistics for 1970 and 1980 large-scale changes occurred in the geographical distribution of each of the four population groups in Southern Africa. These profit and loss migrations that occurred up to 1980 indicated that the population was gradually migrating in a northerly and north-easterly direction. Such migrational moves were particularly significant as far as the provision of effective infrastructures, sufficient and suitable housing, adequate educational facilities and other essential services in specific areas were concerned. The Government's proposed regional development planning for the eight regions of the country, namely all the provinces and the self-governing and independent states will certainly have an important effect on population migration in the future.

The population census figures of 1960, 1970 and 1980 were used to draw up tables containing information on the age distribution of the population and the natural population growth of the different population groups. According to these tables the white population was on average the "oldest" when compared with the other three population groups; both the Asian and the coloured populations were becoming relatively "older", while the high percentage representation of the younger age groups from the black population for the 1980 census year provided unquestionable proof that the black population was rapidly becoming South Africa's "youngest" population group.

The 1970 census results were used to prepare population projections for 1980. Chapter 5 contains a comparison between these population projections and the latest available population census figures of 1980, released by the Central Statistical Services during 1982. The results show that the projections for 1980 regarding whites, coloureds, Asians, blacks as well as the total population, were either too high or too low; in certain cases the projections and the actual figures differed considerably. Reasons offered for the deviations are the following: the lower fertility rate reported by all four population groups; the birth rate for coloureds, Asians and whites decreased by 23 % to 29 %, and the percentage representation of the number of children younger than one year in the total population decreased in the case of whites, coloureds and Asians, but increased in the case of blacks during the period 1960 to 1980. No official data on fertility and birth rates for blacks are available. Predicting and calculating the factors that may cause a drop in birth rate are extremely difficult since so many other variables are also involved.

Report O-300 (Also available in Afrikaans) 1987

Degrees and diplomas conferred upon Blacks by South African universities: 1970 - 1980

JOHANNA H. VAN SCHALKWYK
Z.H.M. RETIEF
P.G. LE ROUX
JOHANNA LABUSCHAGNE

The aim of the investigation was to make an analysis of different aspects of the degrees and diplomas obtained by blacks at the various South African universities during the period 1970 - 1980.

The data in respect of the black graduates were computerized and the different degrees and diplomas on the various study levels were classified according to specific faculties and specialization fields. The growth rate in respect of the number of degrees and diplomas in the various faculties (where possible) was indicated.

With regard to the sexual composition it was found that the percentage of women shows a rising trend with respect to the different degrees. From the data it appears that there was a proportional decline in the number of female graduates as the level of study rose.

During the period 1970 to 1980 arts and education were the most popular fields with regard to first Bachelor's and Master's degrees. The highest percentage of Honours and Doctor's degrees was obtained in education and physical education.

The total number of degrees and diplomas awarded annually increased progressively from 1970 to 1980. The average growth rate in respect of the different study levels was as follows:

*	first Bachelor's degrees	13,40 %
*	second Bachelor's and Honours degrees	16,23 %
*	Master's degrees	25,89 %
*	Doctor's degrees	0,00 %
*	undergraduate diplomas	4,00 %
*	postgraduate diplomas	13,90 %

Report O-303 (Available in English only) 1987

Computer-assisted instruction in Arithmetic/Mathematics with the TOAM system in a number of primary schools: Parts 1, 2 and 3

A. MULLER
J.G. KNOETZE
A. SCHOEMAN
J.G.L. WESSELS

The TOAM system is a system particularly designed for computer-assisted instruction using mainly a testing and practice mode. B & D Education Systems, distributors of the TOAM system in the RSA, approached the HSRC at the end of 1984 with a proposal that a research project be launched monitoring the results obtained when the TOAM system is used to supplement classroom instruction in Arithmetic/Mathematics in a number of primary schools. The research consequently focussed firstly on learning effect obtained when pupils experienced the testing and practice mode of the TOAM system, secondly on prior computer exposure of pupils and teachers and the role this possibly played in the acceptance and use of the system, and thirdly on the way in which pupils and teachers experienced the system during the year in which it was at the disposal of the experimental schools. The pupils completed two lessons of ten minutes each twice a week, making a total of 40 minutes a week spent on the TOAM system for approximately 30 weeks.

A pretest/posttest experimental design was used. Random selection of the experimental and control schools was, however, not possible as participation was negotiated by B & D Education Systems in the case of government schools and private schools. Willingness to participate was the determining factor in the latter case. Statistical techniques were employed to accommodate the lack of random selection.

A number of conclusions were reached at the end of the experiment. The learning results were analysed by standard. Whereas a good many standards did show learning gain which was statistically significant, there were cases where the possibility of chance alone causing the result or the difference obtained between experimental and control groups could not be rejected. In some cases learning effect favoured the control group and in other cases the experimental group. It is clear that the progress experimental pupils showed in terms of the TOAM system's own evaluation of pupil progress was not reflected to the same extent in the postexperimental school average, the postexperimental school mark in Mathematics and the HSRC achievement test in Mathematics. This can be ascribed to the fact that TOAM evaluates and presents problems to the pupil at the level at which he is able to perform, whereas the school evaluation and the HSRC achievement test evaluate on the standard level the pupil is actually in. However, the TOAM average and the HSRC achievement test in Arithmetic/Mathematics were found to be good predictors of achievement in the postexperimental school average, the postexperimental school mark in Mathematics and the HSRC achievement test in Mathematics.

The pupils, it would seem, much enjoyed working on the TOAM system, although it is clear that their attitude to Arithmetic/Mathematics changed and was apparently more negative at the end of the experiment. This tendency appeared in both experimental and control schools.

It would appear furthermore that the TOAM curriculum needs minor adjustments in content and order to be fully compatible with the South African syllabi in Arithmetic/Mathematics.

A large majority of the teachers were positive about the role the computer can play in the teaching of Arithmetic and Mathematics and were in favour of permanent use of the TOAM system. The relation between grade placement of the TOAM system and the percentage or raw score a pupil obtains in the normal subject evaluation at school (tests and examinations) is not easily established. There's also a need for more intensive training in the integration of computer-assisted instruction with the traditional teaching model. The TOAM printout does in fact facilitate this sort of remediation as it can pinpoint the type of problem confronting a pupil.

The following recommendations are made:

- Adjustments should be effected in the TOAM syllabus

- Further attention should be paid to the integration of the computer in general and the TOAM printout in particular in the classroom instructional context

- The remediation component of the TOAM courseware should be extended

- Pupils should have a rudimentary concept of grade placement as, although they want feedback on their progress, they interpret the result simplistically as if it were a percentage

- Further use should be made of the Afrikaans version of TOAM, already proving of value in dual medium and Afrikaans medium schools.

Report 0-306 (Available in English only) 1986

The history of the Transvaal United African Teachers' Association (TAUTA)

L. PIENAAR

PREFACE BY MR L.M. TAUNYANE (President of TAUTA)

During momentous periods of his history man has experienced an irresistable urge to look to the past because it is one constant factor in his changing world. Man looks to the past to provide himself with an understanding of the present, the foundation on which his future must rest. The research for this publication has been an arduous task. It has brought the researcher into contact with many devoted people from many diverse places. This book on the history of TAUTA covering a period of 80 years does not claim to be a full history of the Teachers' Association and its activities in the Transvaal since its inception. It is, rather, an attempt to tell the story of those dedicated men and women who have been instrumental in establishing the association and to describe, and re-assess the main contributions of some of these people. It is also meant to provide a qualitative and quantitative enrichment for readers, to acquaint them with the historical demand for education and community expectations in this regard. The various phases through which TAUTA has passed from time to time since its establishment by the founding fathers in 1904 to the present day are chronicled; how from small beginnings TAUTA has grown and has played a major role in black society and the education of its children. An attempt has been made to present interesting facts to the general reader in a manner that will enable him to see the picture clearly; the history will also encourage both scholar and researcher to seek further and deeper. Account has been taken of the economic, social, political and educational development of the people through the corridors of time. If the reader can see this picture clearly and appreciate the effort that has been made to convey the facts in this compressed form then the object of the book will have been achieved.

Report O-307 (Available in Afrikaans only) 1987

Rekenaarbeheerde onderrig in Wiskunde vir standerd vyf

(Computer-managed instruction in Mathematics for Standard Five)

C. VAN ZYL

The HSRC project on Computer-Managed Instruction (CMI) in Mathematics for Standard 5 was carried out with the following aims in mind:

- To undertake a feasibility study of a system for Computer-Managed Instruction in Mathematics for Standard 5;
- to release the results of the research in the form of teaching programmes as a service to schools.

The Committee of Heads of Education (CHE) gave its permission to launch the project in schools under its jurisdiction in 1978.

A system for Computer-Managed Instruction, making provision for individualized instruction according to learning tempo, for remedial learning assignments as well as for enrichment was planned and developed by researchers. This system was developed in Afrikaans. The computer is used to mark certain diagnostic tests, to give appropriate guidance to individual pupils, to keep records up to date and to print reports. A modular approach was followed when the lesson material was prepared. The syllabus for Mathematics for Standard 5 was analyzed and subsequently divided into sixteen modules. Lesson material satisfying the criteria laid down for this system was developed for four modules. The lesson material was evaluated formatively. Computer programmes were written for the system to enable it to function efficiently on a microcomputer.

The system was implemented in schools during 1983, 1984 and 1985, with the efficiency level of the computer component being raised considerably during this time. Data were obtained by means of observation, interviews, questionnaires for teachers and for pupils, as well as essays written by pupils. The answers given by pupils on the various computer-marked worksheets were analysed, and the way in which remedial work was done was investigated in order to improve the lesson material. Some of the most important observations made during the different phases of the practical implementation of the system, relate to the following:

- The 1985 version of the system is definitely viable for use in schools
- Individualisation is made possible by the system. Pupils with learning or reading problems, and/or in need of additional support from the teacher are often brought to the attention of the teacher by reports generated by the system
- The modular structure of the system is a motivating factor in encouraging independent study
- Socialisation is encouraged because pupils learn to discuss their work with each other, and pupils get to know their own mathematical abilities better
- Appropriate training for the teachers and orientation of the pupils are features of the successful implementation of the system
- Computer literacy is stimulated through using the system
- The functional costs of the system can be calculated in advance. Minimizing costs will be made possible if attention is paid to thorough planning regarding purchases, printing and binding of learning material and also the re-use of certain items.

Some of the more important recommendations made in this report are the following:

* The utilization of computers in education is a topic that calls for attention in the preservice, in-service and also in the further training of teachers. This system of CMI can be used in this regard.

* This system of CMI is ready to be implemented at interested schools. Possible themes for further research in this connection are identified.

* The existing system can be expanded to encompass more lesson material.

* The existing system can be simplified in such a way that teachers and trainers can set up a system of CMI by making use of existing lesson material, for example textbooks already in use.

* The existing system can be modified so that the lesson material, with or without a supporting computer component, can be marketed for use by individuals.

Report O-311 (Available in Afrikaans only) 1987

Die ontwikkeling van 'n bestuursmodel vir die gemeenskapsleersentrum

(The development of a management model for a community learning centre)

G.D. KAMPER

The effective functioning of a community learning centre is the joint responsibility of various interested parties in the local community. In this research an attempt was made to develop a management model for a community learning centre by indicating

- the objectives of community education, particularly with regard to the community's involvement;
- who the parties interested in the community learning centre are, and the expected nature of their involvement in management, and
- how the involvement of the interested parties in management can be implemented in the management structure of the community learning centre, with due consideration to the demands a community learning centre makes on management.

Report 0-315 (Available in Afrikaans only) 1988
Report 0-316 1987

Opleidingscenario's vir die Suid-Afrikaanse brandweerdiens: Dele 1 en 2

(Training scenarios for the South African Fire Services: Parts 1 and 2)

These reports are based on an investigation mainly pertaining to the training of firemen that was undertaken jointly by the South African Fire Services Institute (SAFSI) and the Human Sciences Research Council (HSRC). Investigation results are published respectively in Parts 1 and 2.

This first part of the report is based on general research concerning historical and more recent factors that may exert an influence on the training of firemen. In order to put training into perspective, related factors such as macrostructure, legislation, training categories and facilities, the role of SAFSI and the current diversity in training, which all influence the present situation, are discussed. Next the possible influence of historical factors on current training, the management and control of fire services as well as the financing, evaluation and certification of training receive attention.

Consideration is then given to the influence of factors such as demography, urbanization, politico-economic circumstances, the possible effect of the new political dispensation on fire services, manpower, differentiated training requirements and existing training facilities.

This is followed by a description and evaluation of training programmes, largely based on information obtained from a survey conducted by means of questionnaires. In this respect different curriculum packages, entrance requirements, objectives of fire service training, rank systems and task analysis of applicants are considered. In the light of a national needs analysis a critical evaluation of existing training programmes was carried out. On the basis of the identified needs and shortcomings a number of recommendations are made in Chapter 6. Of these, the need for standardized co-ordinated training is considered to be of primary importance.

The abovementioned recommendation receives high priority in this report and also forms the basis of the various curricula as suggested in Part 2. Curricula for the three certificate and two diploma courses of SAFSI, dealt with in Part 2, were designed by a representative curriculum committee consisting of an advisory committee from SAFSI together with the HSRC.

Strategies for the development of curricula included the following: Data in general, as well as specific data pertaining to their individual curricula for practical training, were obtained by questionnaires from 14 fire service stations. In addition, other bodies that offered specialized or differentiated training were identified and approached in view of their curricula and/or special training needs. These data were processed, and draft curricula for the five SAFSI courses were compiled by a representative curriculum committee. The draft curricula were distributed to interested parties for their comment. Finally the representative committee processed the feedback and incorporated it into the draft curricula with a view to national implementation.

HSRC EDUCATION RESEARCH PROGRAMME No. 7 **1988**

African languages in white primary schools

The HSRC Education Report posed the question whether the method of presentation and the success achieved in teaching African languages in white primary schools should not serve as an example for teaching a third language in all South African schools - provided that the main objective remains the teaching of communication skills to pupils.

The HSRC was commissioned to conduct research on this issue and reference was made to it in the WHITE PAPER ON THE PROVISION OF EDUCATION IN THE RSA (1983). The HSRC established a committee of experts, including representatives of all the provincial education departments, to conduct the research under the leadership of a well-known African language expert, Prof. P. von Staden of RAU. It was decided to examine the position of African languages in white primary schools first of all, and to try and determine how successfully the languages were taught and learnt - in other words to what extent pupils' proficiency had improved after three years' exposure to the teaching of these languages.

The following findings emerged from a questionnaire survey that had been conducted in the four provinces and that had involved African language teachers, school principals and school superintendents (educational advisors):

- If three or four years' university or college training in the subject (language) is considered the minimum qualification, only 23 % of the teachers (respondents) who taught an African language to primary school pupils were qualified to do so.

- Approximately 76 % of the younger teachers (those with less than five years' experience) indicated that they considered their training for African language teaching to have been satisfactory.

- In most cases the teachers also thought that the particular African language taught was the most suitable one.

- The attitude towards the third language was generally positive. It was particularly teachers who were better qualified and who could speak the language well who felt that the attitude of the different groups was positive.

- The better qualified teachers also believed that the basic aim of African language teaching, namely the improvement of communication skills, was in fact realized.

- The use of educational media was alarmingly inadequate. Although 96 % of the teachers indicated that they had a tape recorder at their disposal, 36 % stated that they had used it regularly.

- There were indications that not enough attention was given to oral activities.

- Only two 30 minute periods a week were devoted to African language teaching. Between 48 % and 32 % (depending on the province and school standard) of the school principals indicated that they considered this to be insufficient for the effective promotion of communication skills.

A special measuring instrument was developed to evaluate pupils' receptive and productive language skills. This instrument was applied in all four provinces and in respect of Zulu, Northern Sotho, Southern Sotho and Xhosa and involved a sample of 400 pupils. Schools were visited and pupils were tested by an expert in the relevant language. The pupils' answers were taped and later evaluated by independent persons before a final mark was awarded. The most important findings were the following:

- The pupils could generally answer the questions that tested their receptive aptitude. Loanwords were recognized easily and served as good clues for the weaker pupils. However, many words were not known to the pupils.

- The section of the measuring instrument dealing with the productive (or speech) skill was generally considered very difficult. Pupils' poor performance could apparently be attributed to the fact that they did not get an adequate opportunity for oral practice owing to the limited hours of contact. Although the measuring instrument involved relatively simple questions (compared for example with the threshold level developed in Europe) it was clear that the pupils were not yet sufficiently familiar with the required vocabulary. Pupils found it particularly difficult to formulate sentences.

- Although pupils' receptive skills were satisfactory and their productive skills unsatisfactory at the relatively low level of testing, it should be added that, in spite of the few contact periods, much has been achieved, amongst others, with regard to a greater sensitivety for the language and the users of that language.

Various models were studied with a view to determining their relevance for the teaching of a third language (African language) as a communication language. It was concluded that the so-called "grammar approach" was undesirable and that the curriculum rather had to make allowance for the language functions that pupils would like to or should be able to perform.

Thus the FUNCTIONAL NOTIONAL APPROACH was proposed as being the most suitable for teaching a third language at the senior primary school level. The FUNCTIONAL component refers to the fact that certain communicative functions are performed in a language, for example apologizing, greeting, recommending something or obtaining information. NOTIONS on the other hand refer to the context within which each of these functions can be performed. For example one can apologize (function) for being late (context/notion) or for having trod on someone's toes (notion), etc.

Some of the most important recommendations in the report can be summarized as follows:

- Teaching African languages in white primary schools should be continued as there can be no gainsaying the value of communication skills in these languages. Much success has been achieved, but there is also room for improvement.

- Syllabuses, schedules and teaching should be based on the functional notional approach since pupils' communicative needs form the basis of this approach.

- More time should be made available for African language teaching and it should be spread over a greater number of years with the possibility of including high school years. It seems that only something like a tenth of the time that, according to European experts and standards, is necessary for achieving the minimum survival level for language communication (the so-called threshold level) is available in South African primary schools. This amounts to approximately 90 hours over a period of three years compared with Europe's more than 1 000 hours spread over a five-year period. A serious attempt should therefore be made to get pupils closer to the THRESHOLD LEVEL.

- Careful consideration should also be given to making African languages compulsory examination subjects in order to promote a positive attitude to these subjects. Oral examinations should nevertheless be given preference to written examination.

HSRC EDUCATION RESEARCH PROGRAMME No. 10 1987

Education for the black disabled

Report of the Work Committee: Education for the black disabled of the HSRC Education Research Programme

The Work Committee: Education for the black disabled took as their point of departure the real needs of impaired black children, estimated to be three quarters of a million by 1990. The committee was brought face to face not only with the reality of the figures, but also with the complexity and severity of the problems inherent in specialized education for blacks in the RSA. This has in a special way directed us once more to the consideration of controversial issues such as categorizing and labelling from practical necessity, as well as the debate with regard to mainstream education versus specialized education. As it was necessary to be constantly mindful of cost effectiveness and economic feasibility, the committee faced the challenge of conceptualising and addressing the diversity of needs in real terms. We were at times strongly tempted to follow the easy way of organizing the field according to existing white structures. However, the multi-ethnic nature of the question, the mosaic of languages and the vast number of agents involved in specialized education for blacks (and, per implication, mental health), soon sensitized the committee to keep the particular sociocultural nuances in constant consideration.

The agents involved with the impaired black child in fact range from the traditional African healer, who is to this day an influential factor, to academic perceptions of the requirements in the field. An awareness of sociocultural context and the real priorities and aspirations cherished by blacks as opposed to typical Western projections were strongly in evidence during the subsequent conferences held with the black community, and these considerations will have to be respected. Specialized education for blacks is a complex, profound, wide-ranging and multifarious problem that holds a challenge for creative solutions. This is possible, provided that we are able on the one hand to reconcile long-established perceptions of the whites with the views of blacks, and on the other hand to give the highest priority to comprehensiveness, cost effectiveness and a directed multiprofessional approach.

LIST OF PUBLICATIONS

The following list contains information on reports recently published and released for general circulation by the Institute for Education Research of the HSRC. Prices of reports exclude GST.

A PUBLISHED REPORTS OF THE INSTITUTE FOR EDUCATIONAL RESEARCH

NUMBER : 0-111 **YEAR :** 1983 **PRICE :** R7,60
AUTHOR : DROST, A.W.
TITLE : Aspects of Classroom Practice in Physical Science

NUMBER : 0-112 **YEAR :** 1980 **PRICE :** R0,80
AUTHOR : NIJSSE, J.M.
TITLE : Aanvangsonderrig in die Tweede Taal : 'n Evaluering

NUMBER : 0-112 **YEAR :** 1982 **PRICE :** R4,90
AUTHOR : NIJSSE, J.M.
TITLE : Initial Instruction in the Second Language : An Evaluation

NUMBER : 0-114 **YEAR :** 1981 **PRICE :** R2,55
AUTHOR : VAN SCHALKWYK, J.O.T.
TITLE : Die bevoegdheid van Natuur- en Skeikunde-, Biologie- en Wiskunde-onderwysers volgens bepaalde kwalifikasiekriteria

NUMBER : 0-126 **YEAR :** 1982 **PRICE :** R5,50
AUTHOR : LESCHINSKY, C.C.J.
TITLE : Doelstellings en metodes in tweedetaalonderrig

NUMBER : 0-126 YEAR : 1983 PRICE : R6,95
AUTHOR : LESCHINSKY, C.C.J.
TITLE : Aims and methods in second language instruction

NUMBER : 0-127 YEAR : 1982 PRICE : R6,15
AUTHOR : VAN SCHALKWYK, J.O.T.
TITLE : Die menings van onderwysers en 'n groep deskundiges oor die Biologiesillabusse op sekondêreskoolvlak

---

NUMBER : 0-128 YEAR : 1983 PRICE : R5,70
AUTHOR : TERBLANCHE, T.J.
TITLE : The educational situation in a sample of Ciskeian families

---

NUMBER : 0-157 YEAR : 1983 PRICE : R11,50
AUTHOR : MOSTERT, J.M.
TITLE : Die onderrig in Afrikaans as Tweede Taal aan primêre skole Deel I

NUMBER : 0-158 YEAR : 1984 PRICE : R11,15
AUTHOR : NIEUWENHUIS, F.J., WEIDEMAN, B.P., DE KLERK, J.T.
TITLE : Skoolvoorligtingstelsels in die RSA

NUMBER : 0-159 YEAR : 1983 PRICE : R10,50
AUTHOR : BEUKES, J.H., WEIDEMAN, B.P.
TITLE : Skoolvoorligting van die Direktoraat: Onderwys vir Kleurlinge Deel II. Skoolvoorligting van sekondêre skole

---

NUMBER : 0-160 YEAR : 1983 PRICE : R5,95
AUTHOR : GOUWS, M.
TITLE : Openbaringswyses van hoogbegaafde leerlinge - 'n psigopedagogiese perspektief

---

NUMBER : 0-164 YEAR : 1983 PRICE : R9,00
AUTHOR : JANSEN, C.P.
TITLE : Aanbevelings rakende die tekort aan hoëvlakmannekrag in die natuurwetenskappe en Wiskunde

NUMBER : 0-165 YEAR : 1983 PRICE : R5,40
AUTHOR : DROST, A.M., LOUBSER, C.P., SWANEPOEL, C.H.
TITLE : The effect of some video programmes on pupil achievement in Mathematics, Biology and Physical Science

NUMBER : 0-166 YEAR : 1984 PRICE : R9,10
AUTHOR : WEIDEMAN, B.P.
TITLE : Die posisie van Latyn as vak aan sekondêre skole in the RSA

NUMBER : 0-167 YEAR : 1983 PRICE : R11,35
AUTHOR : REILLY, PAMELA E., HOFMEYR, ELISABET J.M.
TITLE : Pre-primary Education in the RSA

NUMBER : 0-168 YEAR : 1983 PRICE : R5,60
AUTHOR : MAREE, PIETER J.
TITLE : 'n Verantwoording van die plek van Latyn in die skoolkurrikulum

NUMBER : 0-169 YEAR : 1983 PRICE : R6,20
AUTHOR : DE KLERK, J.T. NIEUWENHUIS, F.J.
TITLE : Opvoeding tot verantwoordelikheid met betrekking tot geslagsaangeleenthede Deel II: Die wenslikheid van geslagsopvoeding aan skole vir Kleurlinge

NUMBER : 0-170 YEAR : 1984 PRICE : R6,75
AUTHOR : MOSTERT, J.M.
TITLE : Die onderrig in Afrikaans as Tweede Taal aan primêre skole Deel II

NUMBER : 0-171 YEAR : 1984 PRICE : R5,45
AUTHOR : ENGELBRECHT, C.S., TERBLANCHE, T.J., LEISTNER, G.M.E., DE KLERK, D.
TITLE : Recommendations regarding the role that the University of Venda can play in meeting the manpower needs of Venda

---

NUMBER : 0-172 YEAR : 1984 PRICE : R2,50
AUTHOR : SWANEPOEL, C.H.
TITLE : Die verband tussen die IK's en vakprestasies van st. 10-leerlinge

---

NUMBER : 0-173 YEAR : 1984 PRICE : R6,95
AUTHOR : LOUBSER, C.P.
TITLE : Die personeelposisie en fasiliteite vir die onderrig in die natuurwetenskaplike vakke en Wiskunde aan sekondêre skole van alle onderwysdepartemente in die RSA

NUMBER : 0-174 YEAR : 1984 PRICE : R10,45
AUTHOR : LESCHINSKY, C.C.J.
TITLE : The views of teachers of English as second language in the primary school

---

NUMBER : 0-175 YEAR : 1983 PRICE : R7,65
AUTHOR : GOUWS, M.
TITLE : Die onderwys van begaafde kinders in die VSA

NUMBER : 0-176 YEAR : 1984 PRICE : R8,15
AUTHOR : MULLER, A.
TITLE : Die rekenaar in die onderrig en moontlike beroepsbeoefening van die gehoorgestremde

---

NUMBER : 0-177 YEAR : 1984 PRICE : R4,25
AUTHOR : MULLER, A.
TITLE : The computer in the instruction and possible occupational practice of the hearing-impaired: Conclusions and recommendations

---

NUMBER : 0-177 YEAR : 1984 PRICE : R4,70
AUTHOR : MULLER, A.
TITLE : Die rekenaar in die onderrig en moontlike beroepsbeoefening van die gehoorgestremde: Gevolgtrekkings en aanbevelings

NUMBER : 0-178 YEAR : 1984 PRICE : R7,30
AUTHOR : LESCHINSKY, C.C.J.
TITLE : The views of experts on the teaching of English as second language in the primary school

NUMBER : 0-181 YEAR : 1984 PRICE : R7,10
AUTHOR : LE ROUX, P.G., ENGELBRECHT, C.S., VAN SCHALKWYK, J.H.
TITLE : Die Suid-Afrikaanse Wiskunde-olimpiade: 'n Gevallestudie van die medaljewenners van 1966 tot 1983

NUMBER : 0-181 YEAR : 1985 PRICE : R8,10
AUTHOR : LE ROUX, P.G., ENGELBRECHT, C.S., VAN SCHALKWYK, J.H.
TITLE : The South African Mathematics Olympiad: A case study of the medallists from 1966 to 1983

NUMBER : 0-267 YEAR : 1985 PRICE : R11,35
AUTHOR : DEDNAM, A., BOUWER, A.C.
TITLE : Die identifisering en analisering van probleme wat kinders in die juniorprimêreskoolfase met die spelling van Afrikaans as eerste taal ondervind

NUMBER : 0-268 YEAR : 1985 PRICE : R9,80
AUTHOR : PIENAAR, L.
TITLE : 'n Ondersoek na die doel, aard en inhoud van basiese onderwys in 'n onderwyskundige struktuur: Riglyne vir 'n onderwyspraktyk

NUMBER : 0-269 YEAR : 1985 PRICE : R12,20
AUTHOR : WEIDEMAN, B.P.
TITLE : Ekstrinsieke faktore wat die posisie van Latyn as skoolvak in die RSA beïnvloed

NUMBER : 0-270 YEAR : 1984 PRICE : R9,20
AUTHOR : LABUSCHAGNE, JOHANNA
TITLE : Gradueringstendense ten opsigte van Kleurlinge aan
Suid-Afrikaanse universiteite 1970-1980

NUMBER : 0-277 YEAR : 1985 PRICE : R15,55
AUTHOR : RETIEF, Z.H.M.
TITLE : Gradueringstendense ten opsigte van Blankes aan
Suid-Afrikaanse universiteite: 1970 - 1980

NUMBER : 0-284 YEAR : 1985 PRICE : R15,55
AUTHOR : KAMPER, G.D.
TITLE : Die posisie van st. 5-leerlinge in die gedifferensieerde
onderwysstelsel van SWA

NUMBER : 0-285 YEAR : 1985 PRICE : R17,70
AUTHOR : MOSTERT, J.M.
TITLE : Situasie-analise en die bepaling van doelstellings vir
vakkurrikula

NUMBER : 0-287 YEAR : 1986 PRICE : R14,65
AUTHOR : MOSTERT, J.M.
TITLE : Riglyne vir kurrikulumontwikkeling

NUMBER : 0-290 YEAR : 1985 PRICE : R17,05
AUTHOR : BEZUIDENHOUT, J.J.
TITLE : Vergelykende onderwysstatistieke: Deel I
Bevolkingstatistieke benodig vir onderwysbeplanning
en onderwysvoorsiening

NUMBER : 0-290 YEAR : 1986 PRICE : R16,10
AUTHOR : BEZUIDENHOUT, J.J.
TITLE : Comparative education statistics : Part I
Population statistics required for educational planning
and the provision of education

NUMBER : 0-291 YEAR : 1986 PRICE : R25,65
AUTHOR : RETIEF, Z.H.M., VAN SCHALKWYK, J.H., LABUSCHAGNE, J.
TITLE : Degrees and diplomas conferred upon Indians by South African universities : 1970 - 1980

NUMBER : 0-292 YEAR : 1986 PRICE : R4,50
AUTHOR : TERBLANCHE, T.J., MOSTERT, J.M.
TITLE : Educational needs and problems in Ciskei

NUMBER : 0-293 YEAR : 1986 PRICE : R13,90
AUTHOR : KAMPER, G.D.
TITLE : Die formele en nie-formele onderwysbehoeftes van die gemeenskap van Atlantis

---

NUMBER : 0-298 YEAR : 1986 PRICE : R16,95
AUTHOR : BEZUIDENHOUT, J.J.
TITLE : Vergelykende onderwysstatistieke : Deel II Swart onderwys: 1960 tot 1983

NUMBER : 0-300 YEAR : 1987 PRICE : R24,45
AUTHOR : VAN SCHALKWYK, J.H., LE ROUX, P.G., RETIEF, Z.H.M., LABUSCHAGNE, J.
TITLE : Grade en diplomas toegeken aan swartes aan Suid-Afrikaanse universiteite: 1970-1980

NUMBER : 0-300 YEAR : 1987 PRICE : R24,45
AUTHOR : VAN SCHALKWYK, J.H., LE ROUX, P.G., RETIEF, Z.H.M., LABUSCHAGNE, J.
TITLE : Degrees and diplomas conferred upon blacks by South African universities: 1970 -1980

NUMBER : 0-302 YEAR : 1986 PRICE : R4,60
AUTHOR : MOSTERT, J.M.
TITLE : Riglyne vir kurrikulumontwikkeling: Kortverslag

NUMBER : 0-303 YEAR : 1987 PRICE : R8,90
AUTHOR : MULLER, A. *et al.*
TITLE : Computer assisted instruction in Arithmetic/Mathematics with the TOAM system in a number of primary schools: Part I

NUMBER : 0-304 YEAR : 1987 PRICE : R8,45
AUTHOR : MULLER, A. *et al.*
TITLE : Computer assisted instruction in Arithmetic/Mathematics with the TOAM system in a number of primary schools: Part II

NUMBER : 0-305 YEAR : 1987 PRICE : R10,00
AUTHOR : MULLER, A. *et al.*
TITLE : Computer assisted instruction in Arithmetic/Mathematics with the TOAM system in a number of primary schools: Part III

NUMBER : 0-306 YEAR : 1986 PRICE : R10,80
AUTHOR : PIENAAR, L.
TITLE : The history of the Transvaal United African Teachers' Association (TUATA)

NUMBER : 0-307 YEAR : 1987 PRICE : R11,30
AUTHOR : VAN ZYL, C.
TITLE : Rekenaarbeheerde onderrig in Wiskunde vir standerd 5

NUMBER : 0-311 YEAR : 1987 PRICE : R14,55
AUTHOR : KAMPER, G.D.
TITLE : Die ontwikkeling van 'n bestuursmodel vir die gemeenskapleersentrum

NUMBER : 0-315 YEAR : 1988
AUTHOR : PIENAAR, L.
TITLE : Opleidingscenario's vir die Suid-Afrikaanse brandweerdiens : Deel I

NUMBER : 0-316 YEAR : 1988 PRICE : R20,45
AUTHOR : PIENAAR, L.
TITLE : Opleidingscenario's vir die Suid-Afrikaanse brandweerdiens : Deel II

READING PROGRAMMES

1986 RGN-Leeshulpprogram - primêre skool (2) R500,00

1988 ABBA-program - aanvangs- en remediërende leesonderrig

SCHOOL READINESS PROGRAMME PRICE OF PROGRAMME : R150,00

This programme, together with wall charts and flash cards, is available as a kit. Programmes are available in the following languages: English, Nama/Damara, Herero, Ndonga, Kwanyama, Kwangali, Gciriku, MbuKushu, Losi and Tswana.

NUMBER : 0-115 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Gereedmakingsprogram Deel I
Handleiding vir die onderwyser

NUMBER : 0-116 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Gereedmakingsprogram Deel II
Lees en Taal

NUMBER : 0-118 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Gereedmakingsprogram Deel III
Wiskunde

NUMBER : 0-120 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Gereedmakingsprogram Deel IV
Skrif

NUMBER : 0-129 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Gereedmakingsprogram Deel V
Liggaamsbewegings

NUMBER : 0-130 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Gereedmakingsprogram Deel VI
Handvaardigheid

NUMBER : 0-117 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : My Leeswerkboek

NUMBER : 0-119 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : My Wiskundewerkboek

NUMBER : 0-121 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : My Skrifwerkboek

NUMBER : 0-131 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE : Readiness Programme Part I
Manual for the teacher

NUMBER : 0-132 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE Readiness Programme Part II
Reading and Language

NUMBER : 0-134 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE Readiness Programme Part III
Mathematics

NUMBER : 0-136 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE Readiness Programme Part IV
Writing

NUMBER : 0-138 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE Readiness Programme Part V
Body Movements

NUMBER : 0-139 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE Readiness Programme Part VI
Manual Skills

NUMBER : 0-133 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE My Reading Workbook

NUMBER : 0-135 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE My Mathematics Workbook

NUMBER : 0-137 YEAR : 1986
AUTHOR : DE JONGH, J.M.
HAASBROEK, J.B.
TITLE My Writing Workbook

B PUBLISHED REPORTS OF THE HSRC EDUCATION RESEARCH PROGRAMME

NUMBER : 1 YEAR : 1983 PRICE : R6,35
WORK COMMITTEE: Die rekenaar in onderwys en opleiding
The computer in education and training
TITLE : Die rekenaar in onderwys en opleiding: samevattende verslag
(Afrikaanse verslag: Deel I)

The computer in education and training: findings and recommendations
(English report: Part I)

NUMBER : 1 YEAR : 1983 PRICE : R13,65
WORK COMMITTEE: Die rekenaar in onderwys en opleiding
The computer in education and training
TITLE : Die rekenaar in onderwys en opleiding: ondersteunende verslae
(Afrikaanse verslag: Deel II)

The computer in education and training: supporting reports
(English report: Part II)

NUMBER : 1 YEAR : 1983 PRICE : R4,80
WORK COMMITTEE: Die rekenaar in onderwys en opleiding
The computer in education and training
TITLE : Spesifikasies vir mikrorekenaarstelsels in skole
en ander onderwysinrigtings : riglyne vir gebruikers
(Afrikaanse verslag: Deel III)

Specifications for microcomputer systems in
schools and other educational institutions:
guidelines for users
(English report: Part III)

NUMBER : 1 YEAR : 1983 PRICE : R5,00
WORK COMMITTEE: Die rekenaar in onderwys en opleiding
The computer in education and training
TITLE : Spesifikasies en kriteria vir die ontwerp en evaluering
van onderwysprogrammatuur: riglyne vir gebruikers
(Afrikaanse verslag: Deel IV)

Specifications and criteria for the design and evaluation
of educational courseware: Guidelines for users
(English report: Part IV)

NUMBER : 1 YEAR : 1983 PRICE : R5,15
WORK COMMITTEE: Die rekenaar in onderwys en opleiding
The computer in education and training
TITLE : Strategieë vir die invoer van rekenaarbewustheid en
rekenaargeletterdheid
(Afrikaanse verslag: Deel V)

Strategies for the introduction of computer
awareness and computer literacy
(English report: Part V)

NUMBER : 2 YEAR : 1984 PRICE : R5,75
WORK COMMITTEE: Leerbehoeftes en media-aanwending
Learning needs and media utilization
TITLE : Die benutting van radio en televisie in onderwys
en opleiding
(Afrikaanse verslag)

The use of radio and television in education
and training
(English report)

NUMBER : WS-32 YEAR : 1985 PRICE : R10,50
AUTHOR : STOKER, D.J., ENGELBRECHT, C.S., CROWTHER, N.A.S., DU TOIT, S.H., HERBST, A.
TITLE : Ondersoek na differensiële toelatingsvereistes tot tersiêre onderwysinrigtings
(Afrikaanse verslag)

Investigation into differential entrance requirements for tertiary educational institutions
(English report)

NUMBER : 3 YEAR : 1985 PRICE : R15,00
WORK COMMITTEE: Die opleiding van ambagsmanne
The training of artisans
TITLE : Die RGN/NOR-ondersoek na die opleiding van ambagsmanne in die RSA
(Afrikaanse verslag)

The HSRC/NTB investigation into the training of artisans in the RSA
(English report)

NUMBER : 4 YEAR : 1986 PRICE : R45,20
WORK COMMITTEE: Onderwys vir hoogbegaafde leerlinge
Education for highly gifted pupils
TITLE : Onderwys vir begaafde leerlinge
(Afrikaanse verslag)

Education for gifted pupils
(English report)

NUMBER : 5 YEAR : 1986 PRICE : R9,00
WORK COMMITTEE: Plattelandse onderwys
Education in rural areas
TITLE : Data base for educational and training programmes in rural areas
(Available in English only)

NUMBER : 6 YEAR : 1986 PRICE : R19,37
WORK COMMITTEE: Taal in onderwys en opleiding
Language in education and training
TITLE : The role of language in black education.
Papers presented at the conference on the role of language in black education, Pretoria 17-18 February 1986
(Available in English only)

NUMBER : 7 YEAR : 1986 PRICE : R16,65
WORK COMMITTEE: Projekkomitee: Derde Taal
Project Committee: Third language
TITLE : Afrikatale in blanke primêre skole
(Afrikaanse verslag)

African languages in white primary schools
(English report)

NUMBER : 8 YEAR : 1987 PRICE : R8,80
WORK COMMITTEE: Projekkomitee: Afstandsonderrig
Project Committee: Distance teaching
TITLE : Outeursreg en onderwys en opleiding in die RSA
(Afrikaanse verslag)

Copyright and education and training in the RSA
(English report)

NUMBER : 9 YEAR : 1987
WORK COMMITTEE: Projekkomitee: Afstandsonderrig
Project Committee: Distance teaching
TITLE : Afstandsonderrig in onderwys en opleiding in die RSA
(Afrikaanse verslag)

Distance teaching in education and training in the RSA
(English report)

NUMBER : 10 YEAR : 1987 PRICE : R13,95
WORK COMMITTEE: Onderwys vir swart gestremdes
Education for the black disabled
TITLE : Onderwys vir swart gestremdes
(Afrikaanse verslag)

Education for the black disabled
(English report)